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U.S. DEPARTMENT OF THE INTERIOR
March 3 1849

STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES

Water Resources Data Michigan

Water Year 1989

U.S. GEOLOGICAL SURVEY WATER-DATA REPORT MI-89-1
Prepared in cooperation with the State of Michigan
and with other agencies

CALENDAR FOR WATER YEAR 1989

1988

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U.S. Department of the Interior March 3 1849

State of Michigan Department of Natural Resources

Water Resources Data Michigan

Water Year 1989

by S.P. Blumer, J.C. Failing, W.W. Larson, C.R. Whited, and R.L. LeuVoy

U.S. GEOLOGICAL SURVEY WATER-DATA REPORT MI-89-1
Prepared in cooperation with the State of Michigan
and with other agencies

DEPARTMENT OF THE INTERIOR

MANUEL LUJAN, JR., Secretary

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U.S. Geological Survey
6520 Mercantile Way, Suite 5
Lansing, Michigan 48911

1990

PREFACE

This volume of the annual hydrologic data report of Michigan is one of a series of annual reports that document hydrologic data gathered from the U.S. Geological Survey's surface- and ground-water data-collection networks in each state, Puerto Rico, and the Trust Territories. These records of streamflow, ground-water levels, and quality of water provide the hydrologic information needed by state, local, and federal agencies, and the private sector for developing and managing our Nation's land and water resources.

This report is the culmination of a concerted effort by dedicated personnel of the U.S. Geological Survey who collected, compiled, analyzed, verified, and organized the data, and who typed, edited, and assembled the report. In addition to the authors, who had primary responsibility for assuring that the information contained herein is accurate, complete, and adheres to Geological Survey policy and established guidelines, the following individuals contributed significantly to the collection, processing, and tabulation of the data:

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Water resources data for the 1989 water year for Michigan consists of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water temperature of ground water. This report contains discharge records for 145 streamflow-gaging stations; stage only records for 13 lake-gaging stations; stage and contents for 5 lakes and reservoirs; water-quality records for 21 streamflow-gaging stations; water-level records for 51 observation wells; and water-temperature records for 4 observation wells. Also included are 48 crest-stage partial-record stations and 8 low-flow partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program. Miscellaneous data were collected at 62 measuring sites and 10 water-quality sampling sites. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State, Local, and Federal agencies in Michigan.

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INTRODUCTION

The Water Resources Division of the U.S. Geological Survey, in cooperation with State agencies, obtains a large amount of data pertaining to the water resources of Michigan each water year. These data, accumulated during many water years, constitute a valuable data base for developing an improved understanding of the water resources of the State. To make these data readily available to interested parties outside the Geological Survey, the data are published annually in this report series entitled "Water Resources Data - Michigan."

This report includes records on both surface and ground water in the State. Specifically, it contains: (1) Discharge records for 145 streamflow-gaging stations, 48 crest-stage partial-record stations, 8 low-flow partial-record stations, and 62 miscellaneous sites; (2) stage only records for 13 lake-gaging stations; (3) stage and content records for 5 lakes and reservoirs; (4) water-quality records for 21 streamflow-gaging stations and 10 miscellaneous sites; (5) water-level records for 51 observation wells; and (6) water-temperature records for 4 observation wells. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State, Local, and Federal agencies in Michigan.

This series of annual reports for Michigan began with the 1961 water year with a report that contained only data relating to the quantities of surface water. For the 1964 water year, a similar report was introduced that contained only data relating to water quality. Beginning with the 1975 water year, the report format was changed to present, in one volume, data on quantities of surface water, quality of surface and ground water, and ground-water levels.

Prior to introduction of this series and for several water years concurrent with it, water-resources data for Michigan were published in U.S. Geological Survey Water-Supply Papers. Data on stream discharge and stage and on lake or reservoir contents and stage, through September 1960, were published annually under the title "Surface-Water Supply of the United States, Part 4." For the 1961 through 1970 water years, the data were published in two 5-year reports. Data on chemical quality, temperature, and suspended sediment for the 1941 through 1970 water years were published annually under the title "Quality of Surface Waters of the United States," and water levels for the 1935 through 1974 water years were published under the title "Ground-Water Levels in the United States." The above mentioned Water-Supply Papers may be consulted in the libraries of the principal cities of the United States and may be purchased from U.S. Geological Survey, Books and Open-File Reports Section, Federal Center, Box 25425, Denver, CO 80225.

Publications similar to this report are published annually by the Geological Survey for all States. These official Survey reports have an identification number consisting of the two-letter State abbreviation, the last two digits of the water year, and the volume number. For example, this volume is identified as "U.S. Geological Survey Water-Data Report MI-89-1." For archiving and general distribution, the reports for 1971-74 water years also are identified as water-data reports. These water-data reports are for sale in paper copy or in microfiche by the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161.

Additional information, including current prices, for ordering specific reports may be obtained from the District Chief at the address given on the back of the title page or by telephone (517) 377-1608.

COOPERATION

The U.S. Geological Survey and agencies of the State of Michigan have had cooperative agreements for the collection of water-resource records since 1930. Organizations that assisted in collecting the data in this report through cooperative agreement with the Survey are:

Michigan Department of Natural Resources, David F. Hales, Director, through Land and Water Management Division, D.J. Hall, Chief, and Geological Survey Division, T.R. Segall, Chief.

Michigan Department of Transportation, J.P. Pitz, Director.

Assistance with funds or services was given by the U.S. Army Corps of Engineers in collecting records for 9 gaging stations published in this report. Assistance was also furnished by the National Weather Service, National Oceanic Atmospheric Administration, and U.S. Department of Commerce.

The following organizations aided in collecting records:

Macomb County Board of Supervisors; Oakland County Drain Commission; Genesee County Drain Commission; Kalamazoo County; Otsego County; Wayne County; Huron-Clinton Metropolitan Authority; Cities of Ann Arbor, Cadillac, Clare, Coldwater, Flint, Imlay City, Kalamazoo, Lansing, Mason, Norway, Portage, and Ypsilanti; American Aggregate Co.; Consumers Power Co.; Cleveland Cliffs Iron Co.; Fisher Body Division; Mead Corporation; Indiana Michigan Power Co.; Michigan Sugar Co.; Swift-Eckrich, Inc.; Upper Peninsula Power Co.; and Wisconsin-Electric Power Co.

Organizations that supplied data are acknowledged in the station descriptions.

SUMMARY OF HYDROLOGIC CONDITIONS

Surface Water

In the Upper Peninsula streamflow at Sturgeon River near Sidnaw began the year in the normal range. Rains in October and November contributed to a new maximum monthly mean streamflow of 599 ft^3/s (cubic feet per second) for November. The new monthly mean exceeded the previous monthly mean, recorded in November 1983, by about 50 percent. Streamflow continued in the normal to above-normal range through June, generally following seasonal patterns. After June, streamflow dropped substantially faster than normal, falling to the deficient range during July. Deficient streamflow persisted for the remainder of the water year. No new minimum monthly mean streamflow was recorded. The instantaneous minimum streamflow at Sidnaw was 9.1 ft^3/s on July 24 and 26. In July, streamflow normally is less than 9.1 ft^3/s only about 1 percent of the time. The minimum streamflow at Sidnaw for the period of record, 2.7 ft^3/s, was recorded in September 1976.

In the Lower Peninsula, streamflow patterns were similar to those in the Upper Peninsula from October through June. Normal and above-normal flows were recorded during the first 9 months of the water year. New maximum monthly mean discharges were recorded in November at both index stations in the Lower Peninsula. At Muskegon River at Evart, the new maximum monthly mean slightly exceeded the November 1985 monthly mean. At Red Cedar River at East Lansing, the new maximum monthly mean exceeded the November 1959 monthly mean by about 10 percent. In June, the mean streamflow was the second highest for the period of record at Red Cedar River at East Lansing. Streamflow remained in the above normal range at East Lansing for the remainder of the water year. At Muskegon River at Evart, however, streamflow declined to the normal range in July and remained there through September. Instantaneous minimum streamflows were not as low as those recorded in water year (WY) 1988. The instantaneous minimum streamflow at Red Cedar River at East Lansing is lower than the 1989 WY minimum of 42 ft^3/s about 20 percent of the time. The minimum instantaneous streamflow at Muskegon River at Evart is lower than the 1989 WY minimum of 402 ft^3/s about 7 percent of the time. Figure 1 shows the monthly and annual mean discharge compared with the median discharge during WY 1951-80 at three index stations.

Several streamflow-gaging stations recorded record or near record discharges in WY 1989. In late March and early April, numerous streams in the northern Lower Peninsula recorded high streamflow caused by rain and melting snow. At Muskegon River at Evart, the highest discharge in 56 years was recorded. The peak discharge of 9,040 ft^3/s on March 31 has a recurrence interval of about 100 years. Most of the other stations in the northern Lower Peninsula affected by the flooding had recurrence intervals of about 5 years or less. In the southwestern Lower Peninsula, severe thunderstorms commencing on May 30 resulted in as much as 8 in. of rain in some areas. Streams affected by the storms were located in the upper St. Joseph and Kalamazoo River basins. Streamflow at 11 gaging stations equalled or exceeded previous maximums. New maximum peak discharges for three streamflow-gaging stations, St. Joseph River at Mottville (66 years of record), Nottawa Creek near Athens (23 years of record), and Rabbit River near Hopkins (24 years of record), had recurrence intervals near or slightly above 100 years. Most of the other stations affected by the flooding in the southwestern Lower Peninsula had recurrence intervals of less than 40 years. Later in the month, flood stages were equalled or exceeded along streams in the Detroit area. The Rouge and Clinton River basins were the most severely affected but no new maximum discharges were recorded.

Water levels in the Great Lakes continued to decline from the high levels recorded in WY 1987. Water levels of Lake Superior and Lakes Michigan-Huron were near normal for the entire water year. Levels of Lake Superior were slightly above normal and levels of Lakes Michigan-Huron were slightly below normal. Water levels for Lake Erie and Lake St. Clair were above normal throughout the year. However, at no time were the levels more than 1 ft (feet) above the long-term average. Damage to lake-front property and shoreline was not serious in WY 1989.

Water Quality

Surface-water-quality data were collected at 18 NASQAN stations in WY 1989. Concentrations of dissolved solids and suspended sediments, analyzed from samples collected bimonthly or quarterly at the stations, generally fall within the range of concentrations in previous samples. Although data are collected on a regular frequency, it is desirable to sample rivers at either high or low stage to determine water-quality characteristics at both extremes. During a period of high flow, runoff from the land is the dominant contributor to a river's discharge and chemical character. During a period of low flow, ground water usually influences a river's water discharge and chemical character. Several low-flow and high-flow samples were collected during the year.

Ground Water

Glacial deposits cover most of the State. The outwash sand and gravel in these deposits form the most productive aquifers in the State. Lacustrine sand also is very productive. Poorly sorted, relatively impermeable mixtures of clay, silt, sand, and gravel, that form some till deposits tend to be poor aquifers; clay deposits generally yield little or no water. In most areas of the State, glacial deposits are less than 200 ft thick. In some areas in the northern part of the Lower Peninsula, however, the deposits are greater than 800 ft thick. Sandstone, limestone, and dolomite are the principal bedrock aquifers. Where near enough to land surface to be recharged by precipitation, they yield freshwater. Where deeply buried, however, these rocks commonly yield brackish or salty water.

Annual recharge to aquifers in Michigan ranges from 3 to 18 in. and is derived from precipitation, which averages 31 in. annually.

Water levels were measured at 108 wells in WY 1989. Of these, 51 were selected to comprise a statewide network of observation wells (fig. 10), which is designed to provide statewide areal coverage and to define ground-water conditions in the important aquifers in the State. Water levels in the network of observation wells were generally near average in October but varied considerably throughout the State during the remainder of the year. Water levels in index wells in Chippewa County, in the eastern Upper Peninsula and Oakland County in the southeastern Lower Peninsula were below the long-term average the entire year. The water level recorded at the index well in Oakland County during February was a new monthly minimum. Water levels at the index wells in Clinton County in the southcentral Lower Peninsula and Marquette County in the central Upper Peninsula were above the long-term average the entire year. Record high water levels were recorded for November in Clinton County and for December in Marquette County.

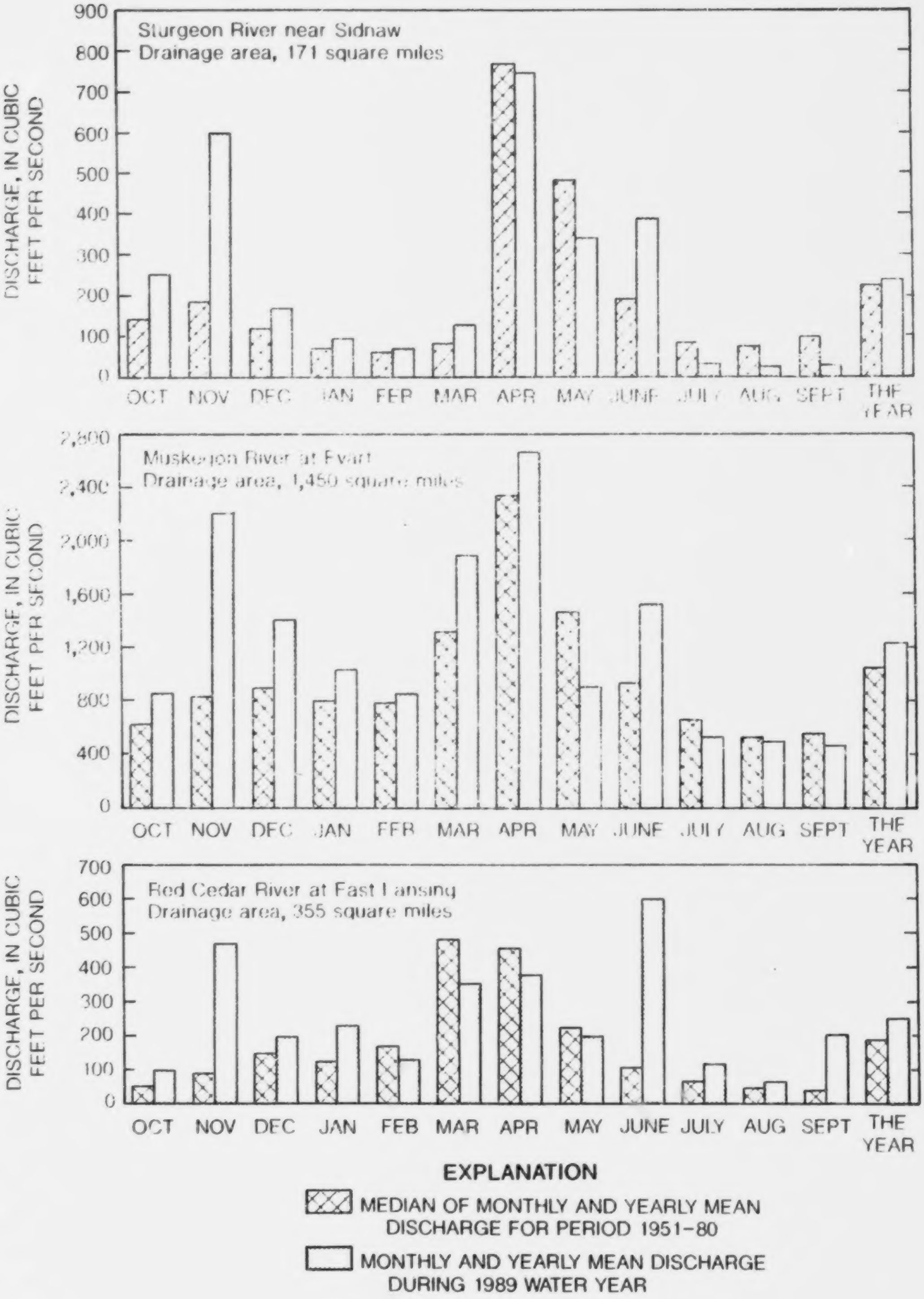


Figure 1.--Discharge during 1989 water year compared with median discharge for period 1951-80 for three representative stations.

The principal aquifers in Michigan are glacial outwash deposits and sandstone, limestone, and dolomite bedrock. The following table lists the aquifers and some of their characteristics.

Aquifer name and description	Well characteristics				Remarks
	Depth (ft)		Yield (gal/min)		
	Common range	May exceed	Common range	May exceed	
Glacial aquifers:					
Outwash: Mostly sand and gravel.	25-200	400	1-1,000	2,000	Water generally hard; iron concentrations common; deep wells may produce salty water in places.
Lacustrine sand: Mostly sand, some gravel.	25-100	200	80-500	500	Used for domestic supply in Saginaw Bay and Detroit areas; is salty in places at depth.
Till: Intermixed clay, silt, sand, gravel and boulders; abundant sand and gravel lenses in some areas.	25-200	400	5-200	200	Primary source of domestic supply in western Upper Peninsula.
Bedrock aquifers:					
Saginaw Formation: Sandstone, siltstone, some shale, limestone, and coal.	25-300	500	100-300	1,000	One of Michigan's most important bedrock aquifers; water generally hard; salty in places at depth.
Marshall Formation: Sandstone and siltstone.	25-200	400	100-500	1,500	Another of Michigan's important bedrock aquifers; salty in places and at depth.
Silurian-Devonian rocks: Limestone and dolomite; some shale and sandstone.	25-150	200	10-300	500	Important aquifer in parts of eastern Upper Peninsula; water commonly hard.
Cambrian-Ordovician rocks: Sandstone, limestone, and dolomite.	25-150	200	10-300	500	Important aquifer in eastern Upper Peninsula; water commonly very hard; salty in places and at depth.
Precambrian sandstone: Sandstone interbedded with siltstone.	25-400	500	5-50	100	Important aquifer in western Upper Peninsula; salty in places.

Natural chemical characteristics of ground water in Michigan are determined primarily by the geologic environment through which the water flows. Natural ground water generally is suitable for human consumption and most other uses. Water from glacial deposits, at places, contains elevated concentrations of iron [2.5 to 5.0 mg/L (milligrams per liter)]; water from carbonate rocks is likely to be very hard (400 to 900 mg/L as calcium carbonate); and water from the Saginaw Formation in the Saginaw Bay-Thumb area commonly is highly mineralized (2,000 to 80,000 mg/L of dissolved solids). Throughout the State, salty water underlies freshwater at depths ranging from about 100 ft in the eastern part of the Lower Peninsula to about 900 ft in the northern part. Average dissolved-solids concentration of water from bedrock (535 mg/L) is about twice as great as the average concentration from glacial deposits (241 mg/L) (Cummings, 1980).

REFERENCES CITED

Cummings, T.R., 1980, Chemical and physical characteristics of natural ground waters in Michigan--A preliminary report: U.S. Geological Survey Open-File Report 80-953, 34 p.

-----, 1984, Estimates of dissolved and suspended yield of stream basins in Michigan: U.S. Geological Survey Water-Resources Investigations Report 83-4288, 57 p.

SPECIAL NETWORKS AND PROGRAMS

Hydrologic Bench-Mark Network is a network of 58 sites in small drainage basins around the country whose purpose is to provide consistent data on the hydrology, including water quality, and related factors in representative undeveloped watersheds nationwide, and to provide analyses on a continuing basis to compare and contrast conditions observed in basins more obviously affected by the activities of man.

National Stream Quality Accounting Network (NASQAN) is a nation-wide data-collection network designed by the U.S. Geological Survey to meet many of the information needs of government agencies and other groups involved in natural or regional water-quality planning and management. The 500 or so sites in NASQAN are generally located at the downstream ends of hydrologic accounting units designated by the U.S. Geological Survey Office of Water Data Coordination in consultation with the Water Resources Council. The objectives of NASQAN are (1) to obtain information on the quality and quantity of water moving within and from the United States through a systematic and uniform process of data collection, summarization, analysis, and reporting such that the data may be used for, (2) description of the areal variability of water quality in the Nation's rivers through analysis of data from this and other programs, (3) detection of changes or trends with time in the pattern of occurrence of water-quality characteristics, and (4) providing a nationally consistent data base useful for water quality assessment and hydrologic research.

Radiochemical Program is a network of regularly sampled water-quality stations where samples are collected to be analyzed for radioisotopes. The streams that are sampled represent major drainage basins in the conterminous United States.

EXPLANATION OF THE RECORDS

The surface-water and ground-water records published in this report are for the 1989 water year that began October 1, 1988, and ended September 30, 1989. A calendar of the water year is provided on the inside of the front cover. The records contain streamflow data, stage and content data for lakes and reservoirs, water-quality data for surface water, and ground-water level data. The locations of the stations and wells where the data were collected are shown in figures 4-10. The following sections of the introductory text are presented to provide users with a more detailed explanation of how the hydrologic data published in this report were collected, analyzed, computed, and arranged for presentation.

Station Identification Numbers

Each data station, whether streamsite or well, in this report is assigned a unique identification number. This number is unique in that it applies specifically to a given station and to no other. The number usually is assigned when a station is first established and is retained for that station indefinitely. The systems used by the U.S. Geological Survey to assign identification numbers for surface-water stations and for ground-water well sites differ, but both are based on geographic location. The "downstream order" system is used for all surface-water stations except some lakes and the "latitude-longitude" system is used for wells and lakes.

Downstream Order System

Since October 1, 1950, the order of listing hydrologic-station records in Survey reports is in a downstream direction along the main stream. All stations on a tributary entering upstream from a mainstream station are listed before that station. A station on a tributary that enters between two mainstream stations is listed between them. A similar order is followed in listing stations on first rank, second rank, and other ranks of tributaries. The rank of any tributary with respect to the stream to which it is immediately tributary is indicated by an indention in the "List of Stations" in the front of this report. Each indention represents one rank. This downstream order and system of indention shows which stations are on tributaries between any two stations and the rank of the tributary on which each station is situated.

The station-identification number is assigned according to downstream order. In assigning station numbers, no distinction is made between partial-record stations and other stations; therefore, the station number for a partial-record station indicates downstream-order position in a list made up of both types of stations. Gaps are left in the series of numbers to allow for new stations that may be established; hence, the numbers are not consecutive. The complete eight-digit number for each station, such as 04037500, which appears just to the left of the station name, includes the two-digit Part number "04" plus the six-digit downstream-order number "037500." The Part number designates the major river basin; for example, Part "04" is the St. Lawrence River basin.

Latitude-Longitude System

The identification numbers for wells are assigned according to the grid system of latitude and longitude. The number consists of 15 digits. The first six digits denote the degrees, minutes, and seconds of latitude, the next seven digits denote degrees, minutes, and seconds of longitude, and the last two digits (assigned sequentially) identify the wells or other sites within a 1-second grid. This site-identification number, once assigned, is a pure number and has no locational significance. In the rare instance where the initial determination of latitude and longitude are found to be in error, the station will retain its initial identification number; however, its true latitude and longitude will be listed in the LOCATION paragraph of the station description. (See figure 2.)

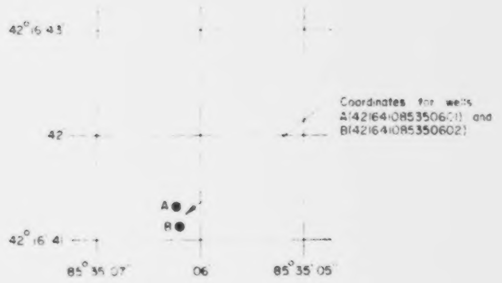

42°16'43"
42
42°16'41"
85°35'07"
06
85°35'05"
Coordinates for wells A(421641085350601) and B(421641085350602)
A
B

Figure 2. System for numbering wells (latitude and longitude).

Local Well Numbering System

The local well number indicates the location of wells within the rectangular subdivision of land with reference to the Michigan meridian and base line. The first two segments of the well number designate township and range, the third segment of the number designates the section and the letters A through D designate successively smaller subdivisions of the section as shown in figure 3. Thus, a well designated as 32N 6E 16CCCB would be located to the nearest 2.5 acres and would be within the shaded area in section 16. In the event that two or more wells are located in the same 2.5 acre tract, a sequential number designation follows the letter designations--for example, 16CCCB1, 16CCCB2, 16CCCB3, etc.

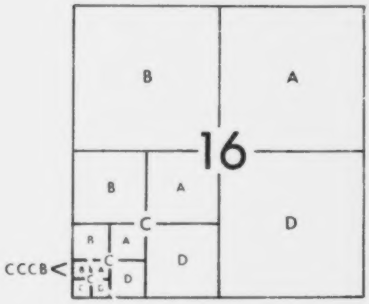


Figure 3. Local well numbering system in Michigan.

Records of Stage and Water Discharge

Records of stage and water discharge may be complete or partial. Complete records of discharge are those obtained using a continuous stage-recording device through which either instantaneous or mean daily discharges may be computed for anytime, or any period of time, during the period of record. Complete records of lake or reservoir content, similarly, are those for which stage or content may be computed or estimated with reasonable accuracy for any time, or period of time. They may be obtained using a continuous stage-recording device, but need not be. Because daily mean discharges and end-of-month contents commonly are published for such stations, they are referred to as "daily stations."

By contrast, partial records are obtained through discrete measurements without using a continuous stage-recording device and pertain only to a few flow characteristics, or perhaps only one. The nature of the partial record is indicated by table titles such as "Crest-stage partial records," or "Low-flow partial records." Records of miscellaneous discharge measurements or of measurements from special studies, such as low-flow seepage studies, may be considered as partial records, but they are presented separately in this report. Location of all complete-record water-discharge stations for which data are given in this report are shown in figures 4 and 5.

Data Collection and Computation

The data obtained at a complete-record gaging station on a stream or canal consist of a continuous record of stage, individual measurements of discharge throughout a range of stages, and notations regarding factors that may affect the relationships between stage and discharge. These data, together with supplemental information, such as weather records, are used to compute daily discharges. The data obtained at a complete-record gaging station on a lake or reservoir consist of a record of stage and of notations regarding factors that may affect the relationship between stage and lake content. These data are used with stage-area and stage-capacity curves or tables to compute water-surface areas and lake storage.

Continuous records of stage are obtained with analog recorders that trace continuous graphs of stage or with digital recorders that punch stage values on paper tapes at selected time intervals. Measurements of discharge are made with current meters using methods adopted by the Geological Survey as a result of experience accumulated since 1880. These methods are described in standard textbooks, in Water-Supply Paper 2175, and in U.S. Geological Survey Techniques of Water-Resources Investigations, Book 3, Chapter A6.

In computing discharge records, results of individual measurements are plotted against the corresponding stages, and stage-discharge relation curves are then constructed. From these curves, rating tables indicating the approximate discharge for any stage within the range of the measurements are prepared. If it is necessary to define extremes of discharge outside the range of the current-meter measurements, the curves are extended using: (1) logarithmic plotting; (2) velocity-area studies; (3) results of indirect measurements of peak discharge, such as slope-area or contracted-opening measurements, and computations of flow over dams or weirs; or (4) step-backwater techniques.

Daily mean discharges are computed by applying the daily mean stages (gage heights) to the stage-discharge curves or tables. If the stage-discharge relation is subject to change because of frequent or continual change in the physical features that form the control, the daily mean discharge is determined by the shifting-control method, in which correction factors based on the individual discharge measurements and notes of the personnel making the measurements are applied to the gage heights before the discharges are determined from the curves or tables. This shifting-control method also is used if the stage-discharge relation is changed temporarily because of aquatic growth or debris on the control. For some stations, formation of ice in the winter may so obscure the stage-discharge relations that daily mean discharges must be estimated from other information such as temperature and precipitation records, notes of observations, and records for other stations in the same or nearby basins for comparable periods.

At some stream-gaging stations, the stage-discharge relation is affected by the backwater from reservoirs, tributary streams, or other sources. This necessitates the use of the slope method in which the slope or fall in a reach of the stream is a factor in computing discharge. The slope or fall is obtained by means of an auxiliary gage set at some distance from the base gage. At some stations the stage-discharge relation is affected by changing stage; at these stations the rate of change in stage is used as a factor in computing discharge.

In computing records of lake or reservoir contents, it is necessary to have available from surveys, curves or tables defining the relationship of stage and content. The application of stage to the stage-content curves or tables gives the contents from which daily, monthly, or yearly changes then are determined. If the stage-content relationship changes because of deposition of sediment in a lake or reservoir, periodic resurveys may be necessary to redefine the relationship. Even when this is done, the contents computed may become increasingly in error as the lapsed time since the last survey increases. Discharges over lake or reservoir spillways are computed from stage-discharge relationships much as other stream discharges are computed

For some gaging stations, there are periods when no gage-height record is obtained, or the recorded gage height is so faulty that it cannot be used to compute daily discharge or contents. This happens when the recorder stops or otherwise fails to operate properly, intakes are plugged, the float is frozen in the well, or for various other reasons. For such periods, the daily discharges are estimated from the recorded range in stage, previous or following record, discharge measurements, weather records, and comparison with other station records from the same or nearby basins. Likewise, daily contents may be estimated from operator's logs, previous or following record, inflow-outflow studies, and other information. Information explaining how estimated daily-discharge values are identified in station records is included in the next two sections, "Data Presentation" (REMARKS paragraph) and "Identifying Estimated Daily Discharge."

Data Presentation

The records published for each gaging station consist of two parts, the manuscript or station description and the data table for the current water year. The manuscript provides, under various headings, descriptive information, such as station location; period of record; average discharge; historical extremes; record accuracy; and other remarks pertinent to station operation and regulation. The following information, as appropriate, is provided with each continuous record of discharge or lake content. Comments to follow clarify information presented under the various headings of the station description.

LOCATION.--Information on locations is obtained from the most accurate maps available. The location of the gage with respect to the cultural and physical features in the vicinity and with respect to the reference place mentioned in the station name is given. River mileages, given for only a few stations, were determined by methods given in "River Mileage Measurement, "Bulletin 14, Revision of October 1968, prepared by the Water Resources Council or were provided by the U.S. Army Corps of Engineers.

DRAINAGE AREA.--Drainage areas are measured using the most accurate maps available. Because the type of maps available varies from one drainage basin to another, the accuracy of drainage areas likewise varies. Drainage areas are updated as better maps become available.

PERIOD OF RECORD.--This indicates the period for which there are published records for the station or for an equivalent station. An equivalent station is one that was in operation at a time that the present station was not, and whose location was such that records from it can reasonably be considered equivalent with records from the present station.

REVISED RECORDS.--Published records, because of new information, occasionally are found to be incorrect, and revisions are printed in later reports. Listed under this heading are all the reports in which revisions have been published for the station and the water years to which the revisions apply. If a revision did not include daily, monthly, or annual figures of discharge, that fact is noted after the year dates as follows: "(M)" means that only the instantaneous maximum discharge was revised; "(m)" that only the instantaneous minimum was revised; and "(P)" that only peak discharges were revised. If the drainage area has been revised, the report in which the most recently revised figure was first published is given.

GAGE.--The type of gage in current use, the datum of the current gage referred to National Geodetic Vertical Datum of 1929 (see glossary), and a condensed history of the types, locations, and datums of previous gages are given under this heading.

REMARKS.--All periods of estimated daily-discharge record will either be identified by date in this paragraph of the station description for water-discharge stations or flagged in the daily-discharge table. (See next section, "Identifying Estimated Daily Discharge.") If a remarks statement is used to identify estimated record, the paragraph will begin with this information presented as the first entry. The paragraph is also used to present information relative to the accuracy of the records, to special methods of computation, to conditions that affect natural flow at the station and, possibly, to other pertinent items. For reservoir stations, information is given on the dam forming the reservoir, the capacity, outlet works and spillway, and purpose and use of the reservoir.

COOPERATION.--Records provided by a cooperating organization or obtained for the Geological Survey by a cooperating organization are identified here.

AVERAGE DISCHARGE.--The discharge value given is the arithmetic mean of the water-year mean discharges. It is computed only for stations having at least 5 water years of complete record, and only water years of complete record are included in the computation. It is not computed for stations where diversions, storage, or other water-use practices cause the value to be meaningless. If water developments significantly altering flow at a station are put into use after the station has been in operation for a period of years, a new average is computed as soon as 5 water years of record have accumulated following the development.

EXTREMES FOR PERIOD OF RECORD.--Extremes may include maximum and minimum stages and maximum and minimum discharges or content. Unless otherwise qualified, the maximum discharge or content is the instantaneous maximum corresponding to the highest stage that occurred. The highest stage may have been obtained from a graphic or digital recorder, a crest-stage gage, or by direct observation of a nonrecording gage. If the maximum stage did not occur on the same day as the maximum discharge or content, it is given separately. Similarly, the minimum is the instantaneous minimum discharge, unless otherwise qualified, and was determined and is reported in the same manner as the maximum.

EXTREMES OUTSIDE PERIOD OF RECORD.--Included here is information concerning major floods or unusually low flows that occurred outside the stated period of record. The information may or may not have been obtained by the U.S. Geological Survey.

EXTREMES FOR CURRENT YEAR.--Extremes given here are similar to those for the period of record, except the peak discharge listing may include secondary peaks. For stations meeting certain criteria, all peak discharges and stages occurring during the water year and greater than a selected base discharge are presented under this heading. The peaks greater than the base discharge, excluding the highest one, are referred to as secondary peaks. Peak discharges are not published for canals, ditches, drains, or streams for which the peaks are subject to substantial control by man. The time of occurrence for peaks is expressed in 24-hour local standard time. For example, 12:30 a.m. is 0030, and 1:30 p.m. is 1330. The minimum for the current water year appears below the table of peak data.

REVISIONS.--If a critical error in published records is discovered, a revision is included in the first report published following discovery of the error.

Although rare, occasionally the records of a discontinued gaging station may need revision. Because, for these stations, there would be no current or, possibly, future station manuscript published to document the revision in a "Revised Records" entry, users of data for these stations who obtained the record from previously published data reports may wish to contact the offices whose addresses are given on the back of the title page of this report to determine if the published records were ever revised after the station was discontinued. Of course, if the data were obtained by computer retrieval, the data would be current and there would be no need to check because any published revision of data is always accompanied by revision of the corresponding data in computer storage.

Manuscript information for lake or reservoir stations differs from that for stream stations in the nature of the "Remarks" and in the inclusion of a skeleton stage-capacity table when daily contents are given.

The daily table for stream-gaging stations gives mean discharge for each day and is followed by monthly and yearly summaries. In the monthly summary below the daily table, the line headed "TOTAL" gives the sum of the daily figures. The line headed "MEAN" gives the average flow in cubic feet per second during the month. The lines headed "MAX" and "MIN" give the maximum and minimum daily discharges, respectively, for the month. Discharge for the month also is usually expressed in cubic feet per second per square mile (line headed "CFSM"), or in inches (line headed "IN."), or in acre-feet (line headed "AC-FT"). Figures for cubic feet per second per square mile and runoff in inches are omitted if there is extensive regulation or diversion or if the drainage area includes large noncontributing areas. In the yearly summary below the monthly summary, the figures shown are the appropriate discharges for the calendar and water years. At some stations monthly and (or) yearly observed discharges are adjusted for reservoir storage or diversion, or diversions or reservoir contents are given. These figures are identified by a symbol and corresponding footnote.

Data collected at partial-record stations follow the information for continuous-record sites. Data for partial-record discharge stations are presented in two tables. The first is a table of annual maximum stage and discharge at crest-stage partial-record stations, and the second is a table of discharge measurements at low-flow partial-record stations. The tables of partial-record stations are followed by a listing of discharge measurements made at sites other than continuous-record or partial-record stations. These measurements are generally made in times of drought or flood to give better areal coverage to those events. Those measurements and others collected for some special reason are called measurements at miscellaneous sites.

Identifying Estimated Daily Discharge

Estimated daily-discharge values published in the water-discharge tables of annual State data reports are identified either by flagging individual daily values with the letter symbol "e" and printing a table footnote, "e Estimated," or by listing the dates of the estimated record in the REMARKS paragraph of the station description.

Accuracy of the Records

The accuracy of streamflow records depends primarily on: (1) The stability of the stage-discharge relation or, if the control is unstable, the frequency of discharge measurements; and (2) the accuracy of measurements of stage, measurements of discharge, and interpretation of records.

The accuracy attributed to the records is indicated under "REMARKS." "Excellent" means that about 95 percent of the daily discharges are within 5 percent of their true values; "good," within 10 percent; and "fair," within 15 percent. Records that do not meet the criteria mentioned are rated "poor." Different accuracies may be attributed to different parts of a given record.

Daily mean discharges in this report are given to the nearest hundredth of a cubic foot per second for values less than 1 ft^3/s; to the nearest tenth between 1.0 and 10 ft^3/s; to whole numbers between 10 and 1,000 ft^3/s; and to 3 significant figures for more than 1,000 ft^3/s. The number of significant figures used is based solely on the magnitude of the discharge value.

Discharge at many stations, as indicated by the monthly mean, may not reflect natural runoff due to the effects of diversion, consumption, regulation by storage, increase or decrease in evaporation due to artificial causes, or to other factors. For such stations, figures of cubic feet per second per square mile and of runoff, in inches, are not published unless satisfactory adjustments can be made for diversions, for changes in contents of reservoirs, or for other changes incident to use and control. Evaporation from a reservoir is not included in the adjustments for changes in reservoir contents, unless it is so stated. Even at those stations where adjustments are made, large errors in computed runoff may occur if adjustments or losses are large in comparison with the observed discharge.

Other Records Available

Information used in the preparation of the records in this publication, such as discharge-measurement notes, gage-height records, temperature measurements, and rating tables are on file in the Michigan District Office. Also, most of the daily mean discharges are in computer-readable form and have been analyzed statistically. Information on the availability of the unpublished information or on the results of statistical analyses of the published records may be obtained from the Michigan District Office.

Records of Surface-Water Quality

Records of surface-water quality ordinarily are obtained at or near stream-gaging stations because interpretation of records of surface water quality nearly always requires corresponding discharge data. Records of surface-water quality in this report may involve a variety of types of data and measurement frequencies.

Classification of Records

Water-quality data for surface-water sites are grouped into one of three classifications. A continuing-record station is a site where data are collected on a regularly scheduled basis. Frequency may be once or more times daily, weekly, monthly, or quarterly. A partial-record station is a site where limited water-quality data are collected systematically over a period of years. Frequency of sampling is usually less than quarterly. A miscellaneous sampling site is a location other than a continuing or partial-record station where random samples are collected to give better areal coverage to define water-quality conditions in the river basin.

A careful distinction needs to be made between "continuing records" , as used in this report, and "continuous recordings," which refers to a continuous graph or a series of discrete values punched at short intervals on a paper tape. Some records of water quality, such as temperature and specific conductance, may be obtained through continuous recordings; however, because of costs, most data are obtained only monthly or less frequently. Locations of stations for which records on the quality of surface water appear in this report are shown in figures 6-7.

Arrangement of Records

Water-quality records collected at a surface-water daily record station are published immediately following that record, regardless of the frequency of sample collection. Station number and name are the same for both records. Where a surface-water daily record station is not available or where the water quality differs significantly from that at the nearby surface-water station, the continuing water-quality record is published with its own station number and name in the regular downstream-order sequence. Water-quality data for miscellaneous sampling sites appear in a separate table following the table of discharge measurements at miscellaneous sites.

On-site Measurements and Sample Collection

In obtaining water-quality data, a major concern needs to be assuring that the data obtained represent the in situ quality of the water. To assure this, certain measurements, such as water temperature, pH, and dissolved oxygen, need to be made on site when the samples are taken. To assure that measurements made in the laboratory also represent the in situ water, carefully prescribed procedures need to be followed in collecting the samples, in treating the samples to prevent changes in quality pending analysis, and in shipping the samples to the laboratory. Procedures for on site measurements and for collecting, treating, and shipping samples are given in publications on "Techniques of Water-Resources Investigations," Book 1, Chap. D2; Book 3, Chap. C2; Book 5, Chap. A1, A3, and A4. All of these references are listed under "PUBLICATIONS ON TECHNIQUES OF WATER-RESOURCES INVESTIGATIONS" which appears at the end of the introductory text. Also, detailed information on collecting, treating, and shipping samples may be obtained from the Geological Survey Michigan District Office.

One sample can define adequately the water quality at a given time if the mixture of solutes throughout the stream cross section is homogeneous. However, the concentration of solutes at different locations in the cross section may vary widely with different rates of water discharge, depending on the source of material and the turbulence and mixing of the stream. Some streams must be sampled through several vertical sections to obtain a representative sample needed for an accurate mean concentration and for use in calculating load. Many samples obtained for the National Stream Quality Accounting Network (see definitions) are obtained from at least several verticals. Whether samples are obtained from the centroid of flow or from several verticals depends on flow conditions and other factors which must be evaluated by the collector.

Chemical-quality data published in this report are considered to be the most representative values available for the stations listed. The values reported represent water-quality conditions at the time of sampling as much as possible, consistent with available sampling techniques and methods of analysis.

For chemical-quality stations equipped with digital monitors, the records consist of daily maximum, minimum, and mean values for each constituent measured and are based upon hourly punches beginning at 0100 hours and ending at 2400 hours for the day of record. More detailed records (hourly values) may be obtained from the Geological Survey Michigan District Office whose address is given on the back of the title page of this report.

Water Temperature

Water temperatures are measured at all the water-quality stations. In addition, water temperatures are taken at time of discharge measurements for water-discharge stations. Large streams have a small diurnal temperature change; shallow streams may have a daily range of several degrees and may follow closely the changes in air temperature. Some streams may be affected by waste-heat discharges.

At stations where recording instruments are used, either mean temperatures and/or maximum and minimum temperatures for each day are published. Water temperatures measured at the time of water-discharge measurements are on file in the Michigan District Office.

Sediment

Suspended-sediment concentrations are determined from samples collected by using depth-integrating samplers. Samples usually are obtained at several verticals in the cross section.

At some stations, suspended-sediment samples were collected periodically at many verticals in the stream cross section. Although data collected periodically may represent conditions only at the time of observations, such data are useful in establishing seasonal relations between quality and streamflow and in predicting long-term sediment-discharge characteristics of the stream.

Laboratory Measurements

Sediment samples were analyzed in the Geological Survey laboratory in Harrisburg, Pennsylvania. All other samples were analyzed in the Geological Survey laboratories in Arvada, Colorado. Methods used in analyzing sediment samples and computing sediment records are given in TWRI, Book 5, Chap. C1. Methods used by the Geological Survey laboratories are given in TWRI, Book 1, Chap. D2; Book 3, Chap. C2; Book 5, Chap. A1, A3, and A4. In March 1989 the National Water-Quality Laboratory discovered a bias in the turbidimetric method for sulfate analysis, indicating that values below 75 mg/L have a median positive bias of 2 mg/L above the true value for the period between 1982 and 1989. Sulfate values in this report have not been corrected for this bias.

Data Presentation

For continuing-record stations, information pertinent to the history of station operation is provided in descriptive headings preceding the tabular data. These descriptive headings give details regarding location, drainage area, period of record, type of data available, instrumentation, general remarks, cooperation, and extremes for parameters currently measured daily. Tables of chemical, physical, biological, radiochemical data, and so forth, obtained at a frequency less than daily are presented first. Tables of "daily values" of specific conductance and water temperature then follow in sequence.

In the descriptive headings, if the location is identical to that of the discharge gaging station, neither the LOCATION nor the DRAINAGE AREA statements are repeated. The following information, as appropriate, is provided with each continuous-record station. Comments that follow clarify information presented under the various headings of the station description.

LOCATION.--See Data Presentation under "Records of Stage and Water Discharge;" same comments apply.

DRAINAGE AREA.--See Data Presentation under "Records of Stage and Water Discharge;" same comments apply.

PERIOD OF RECORD.--This indicates the periods for which there are published water-quality records for the station. The periods are shown separately for records of parameters measured daily or continuously and those measured less than daily. For those measured daily or continuously, periods of record are given for the parameters individually.

INSTRUMENTATION.--Information is given only if a water-quality monitor or temperature recorder is or was in operation at a station.

REMARKS.--Remarks provide added information pertinent to the collection, analysis, or computation of the records.

COOPERATION.--Records provided by a cooperating organization or obtained for the Geological Survey by a cooperating organization are identified here.

EXTREMES.--Maximums and minimums are given only for parameters measured daily or more frequently. None are given for parameters measured weekly or less frequently, because the true maximums or minimums may not have been sampled. Extremes, when given, are provided for both the period of record and for the current water year.

REVISIONS.--If errors in published water-quality records are discovered after publication, appropriate updates are made to the Water-Quality File in the U.S. Geological Survey's computerized data system, WATSTORE, and subsequently by monthly transfer of update transactions to the U.S. Environmental Protection Agency's STORET system. Because the usual volume of updates makes it impractical to document individual changes in the State data-report series or elsewhere, potential users of U.S. Geological Survey water-quality data are encouraged to obtain all required data from the appropriate computer file to insure the most recent updates.

The surface-water quality records for miscellaneous sampling sites are published in a separate table following the table of discharge measurements at miscellaneous sites. No descriptive statements are given for these records. Each station is published with its own station number and name in the regular downstream-order sequence.

Remark Codes

The following remark codes may appear with the water-quality data in this report:

PRINTED OUTPUT	REMARK
E	Estimated value
>	Actual value is known to be greater than the value shown
<	Actual value is known to be less than the value shown
K	Results based on colony count outside the acceptance range (non-ideal colony count)
L	Biological organism count less than 0.5 percent (organism may be observed) rather than counted
D	Biological organism count equal to or greater than 15 percent (dominant)
&	Biological organism estimated as dominant

Records of Ground-Water Levels

Only water-level data from a national network of observation wells are given in this report. These data are intended to provide a sampling and historical record of water level changes in the Nation's most important aquifers. Locations of the observation wells in this network in Michigan are shown in figure 10.

Data Collection and Computation

Measurements of water levels are made in many types of wells under varying conditions, but the methods of measurement are standardized to the extent possible. The equipment and measuring techniques used at each observation well ensure that measurements at each well are of consistent accuracy and reliability.

Tables of water-level data are presented by counties arranged in alphabetical order. The prime identification number for a given well is the 15-digit number that appears in the upper left corner of the table. The secondary identification number is the local well number, an alphanumeric number, derived from the township-range location of the well.

Water-level records are obtained from direct measurements with a steel tape or from the graph or punched tape of a water-stage recorder. The water-level measurements in this report are given in feet with reference to land-surface datum (lsd). Land-surface datum is a datum plane that is approximately at land surface at each well. If known, the elevation of the land-surface datum is given in the well description. The height of the measuring point (MP) above or below land-surface datum is given in each well description. Water levels in wells equipped with recording gages are reported for every fifth day and the end of each month (eom).

Water levels are reported to as many significant figures as can be justified by the local conditions. For example, in a measurement of a depth to water of several hundred feet, the error of determining the absolute value of the total depth to water may be a few tenths of a foot, whereas the error in determining the net change of water level between successive measurements may be only a hundredth or a few hundredths of a foot. For lesser depths to water, the accuracy is greater. Accordingly, most measurements are reported to a hundredth of a foot, but some are given to a tenth of a foot or a larger unit.

Data Presentation

Each well record consists of two parts, the station description and the data table of water levels observed during the water year. The description of the well is presented first through use of descriptive headings preceding the tabular data. The comments to follow clarify information presented under the various headings.

LOCATION.--This paragraph follows the well-identification number and reports the latitude and longitude (given in degrees, minutes, and seconds); the hydrologic-unit number; the distance and direction from a geographic point of reference; and the owner's name.

AQUIFER.--This entry designates by name (if a name exists) and geologic age the aquifer(s) open to the well.

WELL CHARACTERISTICS.--This entry describes the well in terms of depth, diameter, casing depth and/or screened interval, method of construction, use, and additional information such as casing breaks, collapsed screen, and other changes since construction.

INSTRUMENTATION.--This paragraph provides information on both the frequency of measurement and the collection method used, allowing the user to better evaluate the reported water-level extremes by knowing whether they are based on weekly, monthly, or some other frequency of measurement.

DATUM.--This entry describes both the measuring point and the land-surface elevation at the well. The measuring point is described physically (such as top of collar, notch in top of casing, plug in pump base and so on), and in relation to land surface (such as 1.3 ft above land-surface datum). The elevation of the land-surface datum is described in feet above (or below) National Geodetic Vertical Datum of 1929 (NGVD of 1929); it is reported with a precision depending on the method of determination.

REMARKS.--This entry describes factors that may influence the water level in a well or the measurement of the water level. It should identify wells that also are water-quality observation wells, and may be used to acknowledge the assistance of local (non-Survey) observers.

PERIOD OF RECORD.--This entry indicates the period for which there are published records for the well. It reports the month and year of the start of publication of water-level records by the U.S. Geological Survey and the words "to current year" if the records are to be continued into the following year. Periods for which water-level records are available, but are not published by the Geological Survey, may be noted.

EXTREMES FOR PERIOD OF RECORD.--This entry contains the highest and lowest water levels of the period of published record, with respect to land-surface datum, and the dates of their occurrence.

A table of water levels follows the station description for each well. Water levels are reported in feet below land-surface datum and all taped measurements of water level are listed. For wells equipped with recorders, only abbreviated tables are published; generally, only water-level lows are listed for every fifth day and at the end of the month (eom). The highest and lowest water levels of the water year and their dates of occurrence are shown on a line below the abbreviated table. Because all values are not published for wells with recorders, the extremes may be values that are not listed in the table. Missing records are indicated by dashes in place of the water level.

ACCESS TO WATSTORE DATA

The National WATer Data STOrage and REtrieval System (WATSTORE) was established for handling water data collected through the activities of the U.S. Geological Survey and to provide for more effective and efficient means of releasing the data to the public. The system is operated and maintained on the central computer facilities of the Survey at its National Center in Reston, Virginia.

WATSTORE can provide a variety of useful products ranging from simple data tables to complex statistical analyses. A minimal fee, plus the actual computer cost incurred in producing a desired product, is charged to the requester. Information about the availability of specific types of data, the acquisition of data or products, and user charges can be obtained locally from the Michigan District Office.

General inquiries about WATSTORE may be directed to:

Chief Hydrologist
U.S. Geological Survey
409 National Center
12201 Sunrise Valley Drive
Reston, Virginia 22092

DEFINITION OF TERMS

Terms related to streamflow, water-quality, and other hydrologic data, as used in this report, are defined below. See also table for converting English units to International System (SI) Units on the inside of the back cover.

Acre-foot (AC-FT, acre-ft) is the quantity of water required to cover 1 acre to a depth of 1 foot and is equivalent to 43,560 cubic feet or about 326,000 gallons or 1,233 cubic meters.

Adenosine triphosphate (ATP) is an organic, phosphate-rich, compound important in the transfer of energy in organisms. Its central role in living cells makes it an excellent indicator of the presence of living material in water. A measure of ATP therefore provides a sensitive and rapid estimate of biomass. ATP is reported in micrograms per liter of the original water sample.

Algae are mostly aquatic single-celled, colonial, or multi-celled plants, containing chlorophyll and lacking roots, stems, and leaves.

Algal growth potential (AGP) is the maximum algal dry weight biomass that can be produced in a natural water sample under standardized laboratory conditions. The growth potential is the algal biomass present at stationary phase and is expressed as milligrams dry weight of algae produced per liter of sample.

Aquifer is a geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs.

Artesian means confined and is used to describe a well in which the water level stands above the top of the aquifer tapped by the well. A flowing artesian well is one in which the water level is above the land surface.

Bacteria are microscopic unicellular organisms, typically spherical, rodlike, or spiral and threadlike in shape, often clumped into colonies. Some bacteria cause disease, while others perform an essential role in nature in the recycling of materials; for example, by decomposing organic matter into a form available for reuse by plants.

> Total coliform bacteria are a particular group of bacteria that are used as indicators of possible sewage pollution. They are characterized as aerobic or facultative anaerobic, gram-negative, nonspore-forming, rod-shaped bacteria which ferment lactose with gas formation within 48 hours at 35°C. In the laboratory these bacteria are defined as all the organisms that produce colonies with a golden-green metallic sheen within 24 hours when incubated at 35°C plus or minus 1.0°C on M-Endo medium (nutrient medium for bacterial growth). Their concentrations are expressed as number of colonies per 100 mL of sample.
>
> Fecal coliform bacteria are bacteria that are present in the intestine or feces of warm-blooded animals. They are often used as indicators of the sanitary quality of the water. In the laboratory they are defined as all organisms that produce blue colonies within 24 hours when incubated at 44.5°C plus or minus 0.2°C on M-FC medium (nutrient medium for bacterial growth). Their concentrations are expressed as number of colonies per 100 mL of sample.

Fecal streptococcal bacteria are bacteria found also in the intestine of warm-blooded animals. Their presence in water is considered to verify fecal pollution. They are characterized as Gram-positive, cocci bacteria which are capable of growth in brain-heart infusion broth. In the laboratory they are defined as all the organisms which produce red or pink colonies within 48 hours at 35°C plus or minus 1.0°C on KF-streptococcus medium (nutrient medium for bacterial growth). Their concentrations are expressed as number of colonies per 100 mL of sample.

Bed material is the sediment mixture of which a streambed, lake, pond, reservoir, or estuary bottom is composed.

Biochemical oxygen demand (BOD) is a measure of the quantity of dissolved oxygen, in milligrams per liter, necessary for the decomposition of organic matter by micro-organisms, such as bacteria.

Biomass is the amount of living matter present at any given time, expressed as the mass per unit area or volume of habitat.

Ash mass is the mass or amount of residue present after the residue from the dry mass determination has been ashed in a muffle furnace at a temperature of 500°C for 1 hour. The ash mass values of zooplankton and phytoplankton are expressed in grams per cubic meter (g/m^3), and periphyton and benthic organisms in grams per square meter (g/m^2).

Dry mass refers to the mass of residue present after drying in an oven at 105°C for zooplankton and periphyton, until the mass remains unchanged. This mass represents the total organic matter, ash and sediment, in the sample. Dry-mass values are expressed in the same units as ash mass.

Organic mass or volatile mass of the living substance is the difference between the dry mass and ash mass and represents the actual mass of the living matter. The organic mass is expressed in the same units as for ash mass and dry mass.

Wet mass is the mass of living matter plus contained water.

Bottom material: See Bed material.

Cells/volume refers to the number of cells of any organism which is counted by using a microscope and grid or counting cell. Many planktonic organisms are multicelled and are counted according to the number of contained cells per sample, usually milliliters (mL) or liters (L).

Chemical oxygen demand (COD) is a measure of the chemically oxidizable material in the water and furnishes an approximation of the amount of organic and reducing material present. The determined value may correlate with natural water color or with carbonaceous organic pollution from sewage or industrial wastes.

Chlorophyll refers to the green pigments of plants. Chlorophyll a and b are the two most common green pigments in plants.

Color unit is produced by one milligram per liter of platinum in the form of the chloroplatinate ion. Color is expressed in units of the platinum-cobalt scale.

Contents is the volume of water in a reservoir or lake. Unless otherwise indicated, volume is computed on the basis of a level pool and does not include bank storage.

Control designates a feature downstream from the gage that determines the stage-discharge relation at the gage. This feature may be a natural constriction of the channel, an artificial structure, or a uniform cross section over a long reach of the channel.

Control structure as used in this report is a structure on a stream or canal that is used to regulate the flow or stage of the stream or to prevent the intrusion of salt water.

Cubic feet per second per square mile (CFSM) is the average number of cubic feet of water flowing per second from each square mile of area drained, assuming that the runoff is distributed uniformly in time and area.

Cubic foot per second (ft^3/s) is the rate of discharge representing a volume of 1 cubic foot passing a given point during 1 second and is equivalent to 7.48 gallons per second or 448.8 gallons per minute or 0.02832 cubic meters per second.

Cubic foot per second-day [$(ft^3/s)/d$] is the volume of water represented by a flow of 1 cubic foot per second for 24 hours. It is equivalent to 86,400 cubic feet, approximately 1.9835 acre-feet, about 646,000 gallons, or 2,445 cubic meters.

Discharge is the volume of water (or more broadly, volume of fluid plus suspended sediment) that passes a given point within a given period of time.

Mean discharge (MEAN) is the arithmetic mean of individual daily mean discharges during a specific period.

Instantaneous discharge is the discharge at a particular instant of time.

Dissolved refers to that material in a representative water sample which passes through a 0.45 um membrane filter. This is a convenient operational definition used by Federal agencies that collect water data. Determinations of "dissolved" constituents are made on subsamples of the filtrate.

Dissolved-solids concentration of water is determined either analytically by the "residue-on-evaporation" method, or mathematically by totaling the concentrations of individual constituents reported in a comprehensive chemical analysis. During the analytical determination of dissolved solids, the bicarbonate (generally a major dissolved component of water) is converted to carbonate. Therefore, in the mathematical calculation of dissolved-solids concentration, the bicarbonate value, in milligrams per liter, is multiplied by 0.492 to reflect the change.

Drainage area of a stream at a specified location is that area, measured in a horizontal plane, enclosed by a topographic divide from which direct surface runoff from precipitation normally drains by gravity into the stream above the specified point. Figures of drainage area given herein include all closed basins, or noncontributing areas, within the area unless otherwise specified.

Drainage basin is a part of the surface of the earth that is occupied by a drainage system, which consists of a surface stream or a body of impounded surface water together with all tributary surface streams and bodies of impounded surface water.

Gage height (G.H.) is the water-surface elevation referred to some arbitrary gage datum. Gage height is often used interchangeably with the more general term "stage," although gage height is more appropriate when used with a reading on a gage.

Gaging station is a particular site on a stream, canal, lake, or reservoir where systematic observations of hydrologic data are obtained.

Hardness of water is a physical-chemical characteristic that is commonly recognized by the increased quantity of soap required to produce lather. It is computed as the sum of equivalents of polyvalent cations and is expressed as the equivalent concentration of calcium carbonate ($CaCO_3$).

Hydrologic Bench-Mark Network is a network of 58 sites in small drainage basins around the country whose purpose is to provide consistent data on the hydrology, including water quality, and related factors in representative undeveloped watersheds nationwide, and to provide analyses on a continuing basis to compare and contrast conditions observed in basins more obviously affected by the activities of man.

Hydrologic unit is a geographic area representing part or all of a surface drainage basin or distinct hydrologic feature as delineated by the Office of Water Data Coordination on the State Hydrologic Unit Maps; each hydrologic unit is identified by an eight-digit number.

Land-surface datum (lsd) is a datum plane that is approximately at land surface at each ground-water observation well.

Measuring point (MP) is an arbitrary permanent reference point from which the distance to the water surface in a well is measured to obtain the water level.

Metamorphic stage refers to the stage of development that an organism exhibits during its transformation from an immature form to an adult form. This developmental process exists for most insects, and the degree of difference from the immature stage to the adult form varies from relatively slight to pronounced, with many intermediates. Examples of metamorphic stages of insects are egg-larva-adult or egg-nymph-adult.

Methylene blue active substances (MBAS) are apparent detergents. The determination depends on the formation of a blue color when methylene blue dye reacts with synthetic anionic detergent compounds.

Micrograms per gram (ug/g) is a unit expressing the concentration of a chemical constituent as the mass (micrograms) of the element per unit mass (gram) of material analyzed.

Micrograms per liter (UG/L, ug/L) is a unit expressing the concentration of chemical constituents in solution as mass (micrograms) of solute per unit volume (liter) of water. One thousand micrograms per liter is equivalent to one milligram per liter.

Milligrams per liter (MG/L, mg/L) is a unit for expressing the concentration of chemical constituents in solution. Milligrams per liter represents the mass of solute per unit volume (liter) of water. Concentration of suspended sediment also is expressed in mg/L and is based on the mass of dry sediment per liter of water-sediment mixture.

National Geodetic Vertical Datum of 1929 (NGVD of 1929) is a geodetic datum derived from a general adjustment of the first order level nets of both the United States and Canada. It was formerly called "Sea Level Datum of 1929" or "mean sea level" in this series of reports. Although the datum was derived from the average sea level over a period of many years at 26 tide stations along the Atlantic, Gulf of Mexico, and Pacific Coasts, it does not necessarily represent local mean sea level at any particular place.

National Stream Quality Accounting Network (NASQAN) is a nationwide data-collection network designed by the U.S. Geological Survey to meet many of the information needs of government agencies and other groups involved in natural or regional water-quality planning and management. The 500 or so sites in NASQAN are generally located at the downstream ends of hydrologic accounting units designated by the U.S. Geological Survey Office of Water Data Coordination in consultation with the Water Resources Council. The objectives of NASQAN are (1) to obtain information on the quality and quantity of water moving within and from the United States through a systematic and uniform process of data collection, summarization, analysis, and reporting such that the data may be used for, (2) description of the areal variability of water quality in the Nation's rivers through analysis of data from this and other programs, (3) detection of changes or trends with time in the pattern of occurrence of water-quality characteristics, and (4) providing a nationally consistent data base useful for water-quality assessment and hydrologic research.

Organism is any living entity.

Organism count/area refers to the number of organisms collected and enumerated in a sample and adjusted to the number per area habitat, usually square meter (m^2), acre, or hectare. Periphyton, benthic organisms, and macrophytes are expressed in these terms.

Organism count/volume refers to the number of organisms collected and enumerated in a sample and adjusted to the number per sample volume, usually milliliter (mL) or liter (L). Numbers of planktonic organisms can be expressed in these terms.

Total organism count is the total number of organisms collected and enumerated in any particular sample.

Parameter Code is a 5-digit number used in the U.S. Geological Survey computerized data system, WATSTORE, to uniquely identify a specific constituent. The codes used in WATSTORE are the same as those used in the U.S. Environmental Protection Agency data system, STORET. The Environmental Protection Agency assigns and approves all requests for new codes.

Partial-record station is a particular site where limited streamflow and/or water-quality data are collected systematically over a period of years for use in hydrologic analyses.

Particle size is the diameter, in millimeters (mm), of a particle determined by either sieve or sedimentation methods. Sedimentation methods (pipet, bottom-withdrawal tube, visual-accumulation tube) determine fall diameter of particles in either distilled water (chemically dispersed) or in native water (the river water at the time and point of sampling).

Particle-size classification used in this report agrees with the recommendation made by the American Geophysical Union Subcommittee on Sediment Terminology. The classification is as follows:

Classification	Size (mm)	Method of analysis
Clay..........	0.00024 - 0.004	Sedimentation
Silt..........	.004 - .062	Sedimentation
Sand..........	.062 - 2.0	Sedimentation or sieve
Gravel........	2.0 - 64.0	Sieve

The particle-size distributions given in this report are not necessarily representative of all particles in transport in the stream. Most of the organic matter is removed, and the sample is subjected to mechanical and chemical dispersion before analysis in distilled water. Chemical dispersion is not used for native-water analysis.

Percent composition is a unit for expressing the ratio of a particular part of a sample or population to the total sample or population, in terms of types, numbers, mass, or volume.

Periphyton is the assemblage of microorganisms attached to and living upon submerged solid surfaces. While primarily consisting of algae, they also include bacteria, fungi, protozoa, rotifers, and other small organisms.

Pesticides are chemical compounds used to control undesirable organisms. Major categories of pesticides include insecticides, miticides, fungicides, herbicides, and rodenticides.

Picocurie (PC, pCi) is one trillionth (1×10^{-12}) of the amount of radioactivity represented by a curie (Ci). A curie is the amount of radioactivity that yields 3.7×10^{10} radioactive disintegrations per second. A picocurie yields 2.22 dpm (disintegrations per minute).

Plankton is the community of suspended, floating, or weakly swimming organisms that live in the open water of lakes and rivers.

Phytoplankton is the plant part of the plankton. They are usually microscopic and their movement is subject to the water currents. Phytoplankton growth is dependent upon solar radiation and nutrient substances. Because they are able to incorporate as well as release materials to the surrounding water, the phytoplankton have a profound effect upon the quality of the water. They are the primary food producers in the aquatic environment and are commonly known as algae.

Blue-green algae are a group of phytoplankton organisms having a blue pigment, in addition to the green pigment called chlorophyll. Blue-green algae often cause nuisance conditions in water.

Diatoms are the unicellular or colonial algae having a siliceous shell. Their concentrations are expressed as number of cells per milliliter (cells/mL) of sample.

Green algae have chlorophyll pigments similar in color to those of higher green plants. Some forms produce algae mats or floating "moss" in lakes. Their concentrations are expressed as number of cells per milliliter (cells/mL) of sample.

Zooplankton is the animal part of the plankton. Zooplankton are capable of extensive movements within the water column and are often large enough to be seen with the unaided eye. Zooplankton are secondary consumers feeding upon bacteria, phytoplankton, and detritus. Because they are the grazers in the aquatic environment, the zooplankton are a vital part of the aquatic food web. The zooplankton community is dominated by small crustaceans and rotifers.

Polychlorinated biphenyls (PCBs) are industrial chemicals that are mixtures of chlorinated biphenyl compounds having various percentages of chlorine. They are similar in structure to organochlorine insecticides.

Primary productivity is a measure of the rate at which new organic matter is formed and accumulated through photosynthetic and chemosynthetic activity of producer organisms (chiefly, green plants). The rate of primary production is estimated by measuring the amount of oxygen released (oxygen method) or the amount of carbon assimilated by the plants (carbon method).

Milligrams of carbon per area or volume per unit time [mg C/(m^2.time)] for periphyton and macrophytes and [mg C/(m^3.time)] for phytoplankton are units for expressing primary productivity. They define the amount of carbon dioxide consumed as measured by radioactive carbon (carbon 14). The carbon 14 method is of greater sensitivity than the oxygen light and dark bottle method and is preferred for use in unenriched waters. Unit time may be either the hour or day, depending on the incubation period.

Milligrams of oxygen per area or volume per unit time $[\mathrm{mgO_2/(m^2.time)}]$ for periphyton and macrophytes and $[\mathrm{mgO_2/(m^3.time)}]$ for phytoplankton are the units for expressing primary productivity. They define production and respiration rates as estimated from changes in the measured dissolved-oxygen concentration. The oxygen light and dark bottle method is preferred if the rate of primary production is sufficient for accurate measurements to be made within 24 hours. Unit time may be either the hour or day, depending on the incubation period.

Radiochemical program is a network of regularly sampled water-quality stations where samples are collected to be analyzed for radioisotopes. The streams that are sampled represent major drainage basins in the conterminous United States.

Recoverable from bottom material is the amount of a given constituent that is in solution after a representative sample of bottom material has been digested by a method (usually using an acid or mixture of acids) that results in dissolution of readily soluble substances. Complete dissolution of all bottom material is not achieved by the digestion treatment and thus the determination represents less than the total amount (that is, less than 95 percent) of the constituent in the sample. To achieve comparability of analytical data, equivalent digestion procedures would be required of all laboratories performing such analyses because different digestion procedures are likely to produce different analytical results.

Return period is the average time interval between occurrences of a hydrological event of a given or greater magnitude, usually expressed in years. May also be called recurrence interval.

Runoff in inches (IN., in.) shows the depth to which the drainage area would be covered if all the runoff for a given time period were uniformly distributed on it.

Sediment is solid material that originates mostly from disintegrated rocks and is transported by, suspended in, or deposited from water; it includes chemical and biochemical precipitates and decomposed organic material, such as humus. The quantity, characteristics, and cause of the occurrence of sediment in streams are influenced by environmental factors. Some major factors are degree of slope, length of slope, soil characteristics, land usage, and quantity and intensity of precipitation.

Bed load is the sediment that is transported in a stream by rolling, sliding, or skipping along the bed and very close to it. In this report, bed load is considered to consist of particles in transit within 0.25 ft of the streambed.

Bed load discharge (tons per day) is the quantity of bed load measured by dry weight that moves past a section as bed load in a given time.

Suspended sediment is the sediment that at any given time is maintained in suspension by the upward components of turbulent currents or that exists in suspension as a colloid.

Suspended-sediment concentration is the velocity-weighted concentration of suspended sediment in the sampled zone (from the water surface to a point approximately 0.3 ft above the bed) expressed as milligrams of dry sediment per liter of water-sediment mixture (mg/L).

Mean concentration is the time-weighted concentration of suspended sediment passing a stream section during a 24-hour day.

Suspended-sediment discharge (tons/day) is the rate at which dry mass of sediment passes a section of a stream or is the quantity of sediment, as measured by dry mass or volume, that passes a section in a given time. It is calculated in units of tons per day as follows: concentration (mg/L) x discharge ($\mathrm{ft^3/s}$) x 0.0027.

Suspended-sediment load is a general term that refers to material in suspension. It is not synonymous with either discharge or concentration.

Total-sediment discharge (tons/day) is the sum of the suspended-sediment discharge and the bed-load discharge. It is the total quantity of sediment, as measured by dry mass or volume, that passes a section during a given time.

Total-sediment load or total load is a term which refers to the total sediment (bed load plus suspended-sediment load) that is in transport. It is not synonymous with total-sediment discharge.

7-day 10-year low flow (7 Q 10) is the discharge at the 10-year recurrence interval taken from a frequency curve of annual values of the lowest mean discharge for 7 consecutive days (the 7-day low flow).

Sodium-adsorption-ratio (SAR) is the expression of relative activity of sodium ions in exchange reactions within soil and is an index of sodium or alkali hazard to the soil. Waters range in respect to sodium hazard from those which can be used for irrigation on almost all soils to those which are generally unsatisfactory for irrigation.

Solute is any substance that is dissolved in water.

Specific conductance is a measure of the ability of a water to conduct an electrical current. It is expressed in microsiemens per centimeter at 25°C. Specific conductance is related to the type and concentration of ions in solution and can be used for approximating the dissolved-solids content of the water. Commonly, the concentration of dissolved solids (in milligrams per liter) is about 65 percent of the specific conductance (in microsiemens). This relation is not constant from stream to stream, and it may vary in the same source with changes in the composition of the water.

Stage-discharge relation is the relation between gage height (stage) and volume of water, per unit of time, flowing in a channel.

Streamflow is the discharge that occurs in a natural channel. Although the term "discharge" can be applied to the flow of a canal, the word "streamflow" uniquely describes the discharge in a surface stream course. The term "streamflow" is more general than "runoff" as streamflow may be applied to discharge whether or not it is affected by diversion or regulation.

Substrate is the physical surface upon which an organism lives.

Natural substrate refers to any naturally occurring emersed or submersed solid surface, such as a rock or tree, upon which an organism lives.

Artificial substrate is a device which is purposely placed in a stream or lake for colonization of organisms. The artificial substrate simplifies the community structure by standardizing the substrate from which each sample is taken. Examples of artificial substrates are basket samplers (made of wire cages filled with clean streamside rocks) and multiplate samplers (made of hardboard) for benthic organism collection, and plexiglass strips for periphyton collection.

Surface area of a lake is that area outlined on the latest U.S.G.S. topographic map as the boundary of the lake and measured by a planimeter in acres. In localities not covered by topographic maps, the areas are computed from the best maps available at the time planimetered. All areas shown are those for the stage when the planimetered map was made.

Surficial bed material is the part (0.1 to 0.2 ft) of the bed material that is sampled using U.S. Series Bed-Material Samplers.

Suspended (as used in tables of chemical analyses) refers to the amount (concentration) of undissolved material in a water-sediment mixture. It is associated with the material retained on a 0.45-micrometer filter.

Suspended, recoverable is the amount of a given constituent that is in solution after the part of a representative water-suspended sediment sample that is retained on a 0.45 um membrane filter has been digested by a method (usually using a dilute acid solution) that results in dissolution of only readily soluble substances. Complete dissolution of all the particulate matter is not achieved by the digestion treatment and thus the determination represents something less than the "total" amount (that is, less than 95 percent) of the constituent present in the sample. To achieve comparability of analytical data, equivalent digestion procedures are required of all laboratories performing such analyses because different digestion procedures are likely to produce different analytical results.

Determinations of "suspended, recoverable" constituents are made either by analyzing portions of the material collected on the filter or, more commonly, by difference, based on determinations of (1) dissolved and (2) total recoverable concentrations of the constituent.

Suspended, total is the total amount of a given constituent in the part of a representative water-suspended sediment sample that is retained on a 0.45 um membrane filter. This term is used only when the analytical procedure assures measurement of at least 95 percent of the constituent determined. A knowledge of the expected form of the constituent in the sample, as well as the analytical methodology used, is required to determine when the results should be reported as "suspended, total."

Determinations of "suspended, total" constituents are made either by analyzing portions of the material collected on the filter or, more commonly, by difference, based on determinations of (1) dissolved and (2) total concentrations of the constituent.

Taxonomy is the division of biology concerned with the classification and naming of organisms. The classification of organisms is based upon a hierarchial scheme beginning with Kingdom and ending with Species at the base. The higher the classification level, the fewer features the organisms have in common. For example, the taxonomy of a particular mayfly, Hexagenia limbata, is the following:

Kingdom....................	Animal
Phylum.....................	Arthropoda
Class......................	Insecta
Order......................	Ephemeroptera
Family.....................	Ephemeridae
Genus......................	Hexagenia
Species....................	Hexagenia limbata

Thermograph is an instrument that continuously records variations of temperature on a chart. The more general term "temperature recorder" is used in the table headings and refers to any instrument that records temperature whether on a chart, a tape, or any other medium.

Time-weighted average is computed by multiplying the number of days in the sampling period by the concentrations of individual constituents for the corresponding period and dividing the sum of the products by the total number of days. A time-weighted average represents the composition of water that would be contained in a vessel or reservoir that had received equal quantities of water from the stream each day for the year.

Tons per acre-foot indicates the dry mass of dissolved solids in 1 acre-foot of water. It is computed by multiplying the concentration of the constituent, in milligrams per liter, by 0.00136.

Tons per day (T/DAY) is the quantity of a substance in solution or suspension that passes a stream section during a 24-hour period.

Total is the total amount of a given constituent in a representative water-suspended sediment sample, regardless of the constituent's physical or chemical form. This term is used only when the analytical procedure assures measurement of at least 95 percent of the constituent present in both the dissolved and suspended phases of the sample. A knowledge of the expected form of the constituent in the sample, as well as the analytical methodology used, is required to judge when the results should be reported as "total." (Note that the word "total" does double duty here, indicating both that the sample consists of a water-suspended sediment mixture and that the analytical method determined all of the constituent in the sample.)

Total discharge is the total quantity of any individual constituent, as measured by dry mass or volume, that passes through a stream cross-section per unit of time. This term needs to be qualified, such as "total sediment discharge," "total chloride discharge," and so on.

Total, recoverable is the amount of a given constituent that is in solution after a representative water-suspended sediment sample has been digested by a method (usually using a dilute acid solution) that results in dissolution of only readily soluble substances. Complete dissolution of all particulate matter is not achieved by the digestion treatment, and thus the determination represents something less than the "total" amount (that is, less than 95 percent) of the constituent present in the dissolved and suspended phases of the sample. To achieve comparability of analytical data, equivalent digestion procedures are required of all laboratories performing such analyses because different digestion procedures are likely to produce different analytical results.

Water year in Geological Survey reports dealing with surface-water supply is the 12-month period, October 1 through September 30. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months. Thus, the year ending September 30, 1988, is called the "1988 water year."

WDR is used as an abbreviation for "Water-Data Report" in the REVISED RECORDS paragraph to refer to State annual hydrologic-data reports (WRD was used as an abbreviation for "Water-Resources Data" in reports published prior to 1976).

Weighted average is used in this report to indicate discharge-weighted average. It is computed by multiplying the discharge for a sampling period by the concentrations of individual constituents for the corresponding period and dividing the sum of the products by the sum of the discharges. A discharge-weighted average approximates the composition of water that would be found in a reservoir containing all the water passing a given location during the water year after thorough mixing in the reservoir.

WSP is used as an abbreviaton for "Water-Supply Paper" in reference to previously published reports.

PUBLICATIONS ON TECHNIQUES OF WATER-RESOURCES INVESTIGATIONS

The U.S. Geological Survey publishes a series of manuals describing procedures for planning and conducting specialized work in water-resources investigations. The material is grouped under major subject headings called books and is further divided into sections and chapters. For example, Section A of Book 3 (Applications of Hydraulics) pertains to surface water. The chapter, the unit of publication, is limited to a narrow field of subject matter. This format permits flexibility in revision and publication as the need arises.

The reports listed below are for sale by the U.S. Geological Survey, Books and Open-File Reports Section, Federal Center, Box 25425, Denver, Colorado 80225 (authorized agent of the Superintendent of Documents, Government Printing Office). Prepayment is required. Remittance should be sent by check or money order payable to the U.S. Geological Survey. Prices are not included because they are subject to change. Current prices can be obtained by writing to the above address. When ordering or inquiring about prices for any of these publications, please give the title, book number, chapter number, and "U.S. Geological Survey Techniques of Water-Resources Investigations."

1-D1. *Water temperature--influential factors, field measurement, and data presentation*, by H. H. Stevens, Jr., J. F. Ficke, and G. F. Smoot: USGS--TWRI Book 1, Chapter D1. 1975. 65 pages.

1-D2. *Guidelines for collection and field analysis of ground-water samples for selected unstable constituents*, by W. W. Wood: USGS--TWRI Book 1, Chapter D2. 1976. 24 pages.

2-D1. *Application of surface geophysics to ground-water investigations*, by A. A. R. Zohdy, G. P. Eaton, and D. R. Mabey: USGS--TWRI Book 2, Chapter D1. 1974. 116 pages.

2-D2. *Application of seismic-refraction techniques to hydrologic studies*, by F. P. Haeni: USGS--TWRI Book 2, Chapter D2. 1988. 86 pages.

2-E1. *Application of borehole geophysics to water-resources investigations*, by W. S. Keys and L. M. MacCary: USGS--TWRI Book 2, Chapter E1. 1971. 126 pages.

2-F1. *Application of drilling, coring, and sampling techniques to test holes and wells*, by Eugene Shuter and Warren E. Teasdale: USGS--TWRI Book 2, Chapter F1. 1989. 97 pages.

3-A1. *General field and office procedures for indirect discharge measurements*, by M. A. Benson and Tate Dalrymple: USGS--TWRI Book 3, Chapter A1. 1967. 30 pages.

3-A2. *Measurement of peak discharge by the slope-area method*, by Tate Dalrymple and M. A. Benson: USGS--TWRI Book 3, Chapter A2. 1967. 12 pages.

3-A3. *Measurement of peak discharge at culverts by indirect methods*, by G. L. Bodhaine: USGS--TWRI Book 3, Chapter A3. 1968. 60 pages.

3-A4. *Measurement of peak discharge at width contractions by indirect methods*, by H. F. Matthai: USGS--TWRI Book 3, Chapter A4. 1967. 44 pages.

3-A5. *Measurement of peak discharge at dams by indirect methods*, by Harry Hulsing: USGS--TWRI Book 3, Chapter A5. 1967. 29 pages.

3-A6. *General procedure for gaging streams*, by R. W. Carter and Jacob Davidian: USGS--TWRI Book 3, Chapter A6. 1968. 13 pages.

3-A7. *Stage measurements at gaging stations*, by T. J. Buchanan and W. P. Somers: USGS--TWRI Book 3. Chapter A7. 1968. 28 pages.

3-A8. *Discharge measurements at gaging stations*, by T. J. Buchanan and W. P. Somers: USGS--TWRI Book 3, Chapter A8. 1969. 65 pages.

3-A9. *Measurement of time of travel in streams by dye tracing*, by F. A. Kilpatrick and J. F. Wilson, Jr.: USGS--TWRI Book 3, Chapter A9. 1989. 27 pages.

3-A10. *Discharge ratings at gaging stations*, by E. J. Kennedy: USGS--TWRI Book 3, Chapter A10. 1984. 59 pages.

3-A11. *Measurement of discharge by moving-boat method*, by G. F. Smoot and C. E. Novak: USGS--TWRI Book 3, Chapter A11. 1969. 22 pages.

3-A12. *Fluorometric procedures for dye tracing*, by J. F. Wilson, Jr., E. D. Cobb, and F. A. Kilpatrick: USGS--TWRI Book 3, Chapter A12. 1986. 41 pages.

3-A13. *Computation of continuous records of streamflow*, by E. J. Kennedy: USGS--TWRI Book 3, Chapter A13. 1983. 53 pages.

3-A14. *Use of flumes in measuring discharge*, by F. A. Kilpatrick and V. R. Schneider: USGS--TWRI Book 3, Chapter A14. 1983. 46 pages.

3-A15. *Computation of water-surface profiles in open channels*, by Jacob Davidian: USGS--TWRI Book 3, Chapter A15. 1984. 48 pages.

3-A16. *Measurement of discharge using tracers*, by F. A. Kilpatrick and E. D. Cobb: USGS--TWRI Book 3, Chapter A16. 1985. 52 pages.

3-A17. *Acoustic velocity meter systems*, by Antonius Laenen: USGS--TWRI Book 3, Chapter A17. 1985. 38 pages.

3-A18. *Determination of stream reaeration coefficients by use of tracers*, by F. A. Kilpatrick, R. E. Rathbun, N. Yotsukura, G. W. Parker, and L. L. DeLong: USGS--TWRI Book 3, Chapter A18. 1989. 52 pages.

3-B1. *Aquifer-test design, observation, and data analysis*, by R. W. Stallman: USGS--TWRI Book 3, Chapter B1. 1971. 26 pages.

3-B2. *Introduction to ground-water hydraulics, a programmed text for self-instruction*, by G. D. Bennett: USGS--TWRI Book 3, Chapter B2. 1976. 172 pages.

3-B3. *Type curves for selected problems of flow to wells in confined aquifers*, by J. E. Reed: USGS--TWRI Book 3, Chapter B3. 1980. 106 pages.

3-B5. *Definition of boundary and initial conditions in the analysis of saturated ground-water flow systems--An introduction*, by O. L. Franke, T. E. Reilly, and G. D. Bennett: USGS--TWRI Book 3, Chapter B5. 1987. 15 pages.

3-B6. *The principle of superposition and its application in ground-water hydraulics*, by T. E. Reilly, O. L. Franke, and G. D. Bennett: USGS--TWRI Book 3, Chapter B6. 1987. 28 pages.

3-C1. *Fluvial sediment concepts*, by H. P. Guy: USGS--TWRI Book 3, Chapter C1. 1970. 55 pages.

3-C2. *Field methods for measurement of fluvial sediment*, by H. P. Guy and V. W. Norman: USGS--TWRI Book 3, Chapter C2. 1970. 59 pages.

3-C3. *Computation of fluvial-sediment discharge*, by George Porterfield: USGS--TWRI Book 3, Chapter C3. 1972. 66 pages.

4-A1. *Some statistical tools in hydrology*, by H. C. Riggs: USGS--TWRI Book 4, Chapter A1. 1968. 39 pages.

4-A2. *Frequency curves*, by H. C. Riggs: USGS--TWRI Book 4, Chapter A2. 1968. 15 pages.

4-B1. *Low-flow investigations*, by H. C. Riggs: USGS--TWRI Book 4, Chapter B1. 1972. 18 pages.

4-B2. *Storage analyses for water supply*, by H. C. Riggs and C. H. Hardison: USGS--TWRI Book 4, Chapter B2. 1973. 20 pages.

4-B3. *Regional analyses of streamflow characteristics*, by H. C. Riggs: USGS--TWRI Book 4, Chapter B3. 1973. 15 pages.

4-D1. *Computation of rate and volume of stream depletion by wells*, by C. T. Jenkins: USGS-TWRI Book 4, Chapter D1. 1970. 17 pages.

5-A1. *Methods for determination of inorganic substances in water and fluvial sediments*, by M. J. Fishman and L. C. Friedman: USGS--TWRI Book 5, Chapter A1. 1989. 545 pages.

5-A2. *Determination of minor elements in water by emission spectroscopy*, by P. R. Barnett and E. C. Mallory, Jr.: USGS--TWRI Book 5, Chapter A2. 1971. 31 pages.

5-A3. *Methods for the determination of organic substances in water and fluvial sediments*, edited by R. L. Wershaw, M. J. Fishman, R. R. Grabbe, and L. E. Lowe: USGS--TWRI Book 5, Chapter A3. 1987. 80 pages.

5-A4. *Methods for collection and analysis of aquatic biological and microbiological samples*, by L. J. Britton and P. E. Greeson, editors: USGS--TWRI Book 5, Chapter A4. 1989. 363 pages.

5-A5. *Methods for determination of radioactive substances in water and fluvial sediments*, by L. L. Thatcher, V. J. Janzer, and K. W. Edwards: USGS--TWRI Book 5, Chapter A5. 1977. 95 pages.

5-A6. *Quality assurance practices for the chemical and biological analyses of water and fluvial sediments*, by L. C. Friedman and D. E. Erdmann: USGS--TWRI Book 5, Chapter A6. 1982. 181 pages.

5-C1. *Laboratory theory and methods for sediment analysis*, by H. P. Guy: USGS--TWRI Book 5, Chapter C1. 1969. 58 pages.

6-A1. *A modular three-dimensional finite-difference ground-water flow model*, by M. G. McDonald and A. W. Harbaugh: USGS--TWRI Book 6, Chapter A1. 1988. 586 pages.

7-C1. *Finite difference model for aquifer simulation in two dimensions with results of numerical experiments*, by P. C. Trescott, G. F. Pinder, and S. P. Larson: USGS--TWRI Book 7, Chapter C1. 1976. 116 pages.

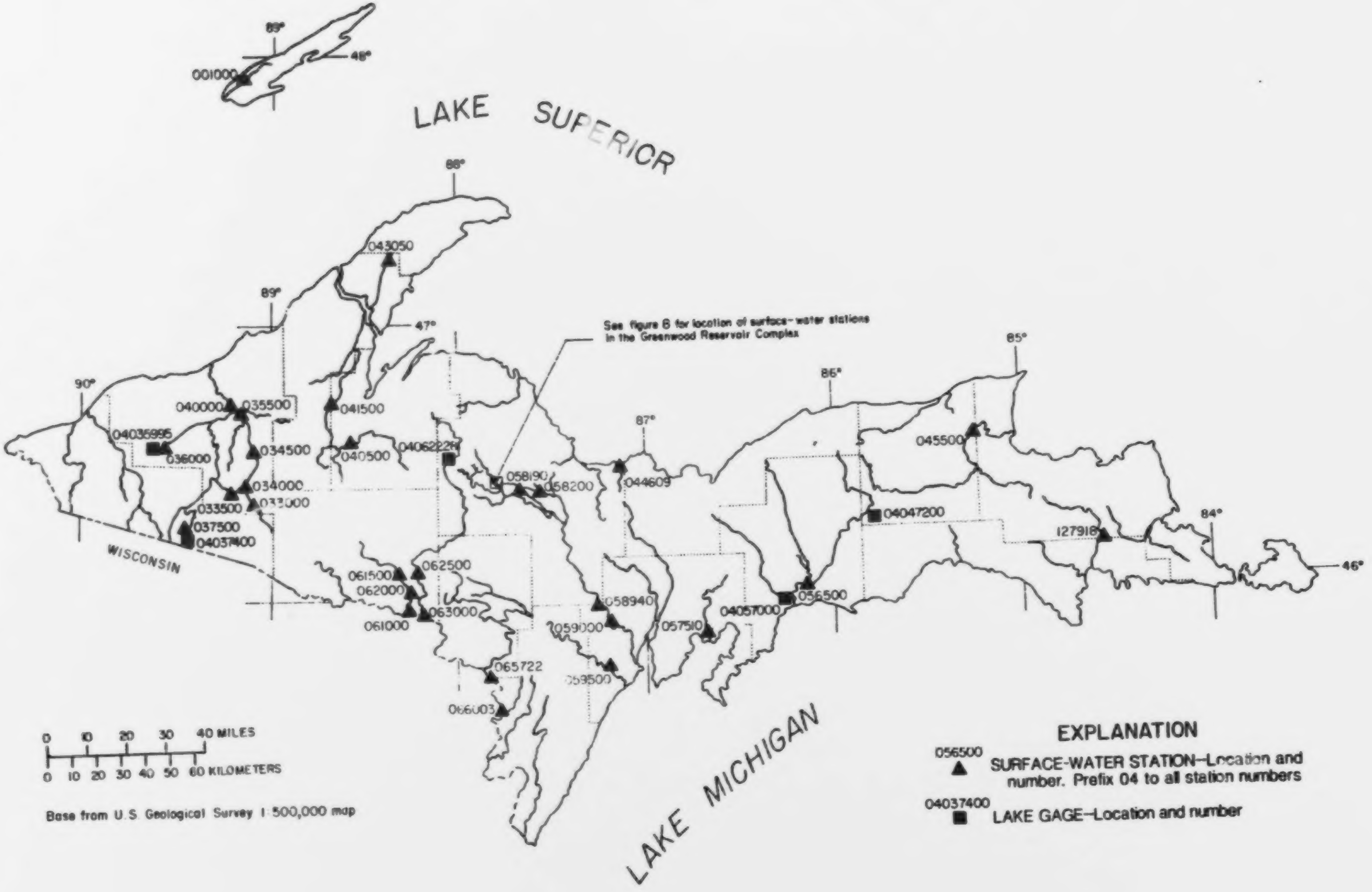
7-C2. *Computer model of two-dimensional solute transport and dispersion in ground water*, by L. F. Konikow and J. D. Bredehoeft: USGS--TWRI Book 7, Chapter C2. 1978. 90 pages.

7-C3. *A model for simulation of flow in singular and interconnected channels*, by R. W. Schaffranek, R. A. Baltzer, and D. E. Goldberg: USGS--TWRI Book 7, Chapter C3. 1981. 110 pages.

8-A1. *Methods of measuring water levels in deep wells*, by M. S. Garber and F. C. Koopman: USGS--TWRI Book 8, Chapter A1. 1968. 23 pages.

8-A2. *Installation and service manual for U.S. Geological Survey manometers*, by J. D. Craig: USGS--TWRI Book 8, Chapter A2. 1983. 57 pages.

8-B2. *Calibration and maintenance of vertical-axis type current meters*, by G. F. Smoot and C. E. Novak: USGS--TWRI Book 8, Chapter B2. 1968. 15 pages.



Base from U.S. Geological Survey 1:500,000 map

Figure 4.--Identification number and location of active surface-water gaging stations in the Upper Peninsula of Michigan.

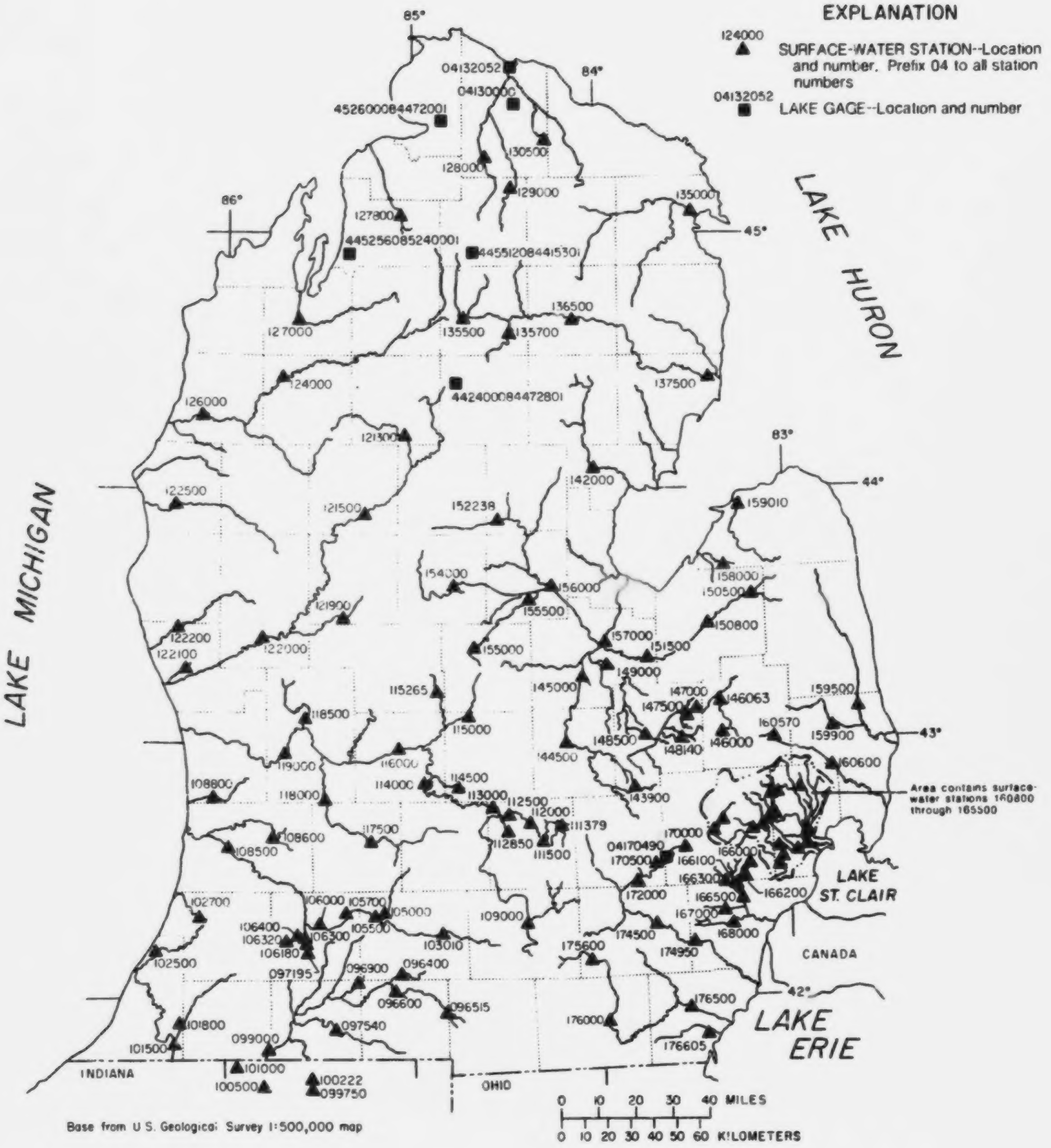


Figure 5.--Identification number and location of active surface-water gaging stations in the Lower Peninsula of Michigan.

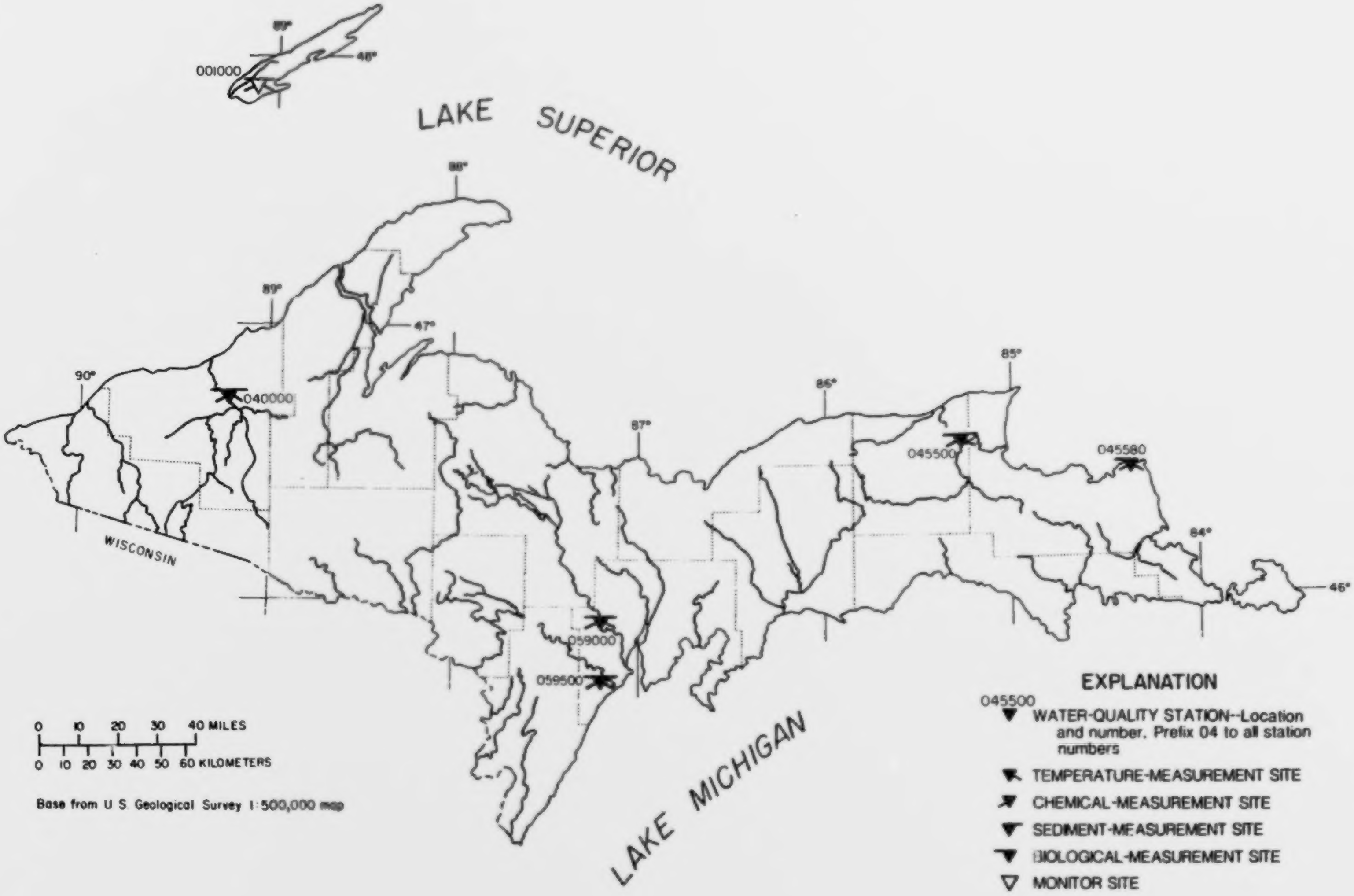

001000
89°
48°
LAKE SUPERIOR
88°
89°
47°
90°
040000
86°
85°
87°
045500
045580
84°
46°
WISCONSIN
059000
059500
LAKE MICHIGAN
0 10 20 30 40 MILES
0 10 20 30 40 50 60 KILOMETERS
Base from U S Geological Survey 1:500,000 map
EXPLANATION
045500
WATER-QUALITY STATION--Location and number. Prefix 04 to all station numbers
TEMPERATURE-MEASUREMENT SITE
CHEMICAL-MEASUREMENT SITE
SEDIMENT-MEASUREMENT SITE
BIOLOGICAL-MEASUREMENT SITE
MONITOR SITE

Figure 6.--Identification number and location of active surface-water-quality stations in the Upper Peninsula of Michigan.

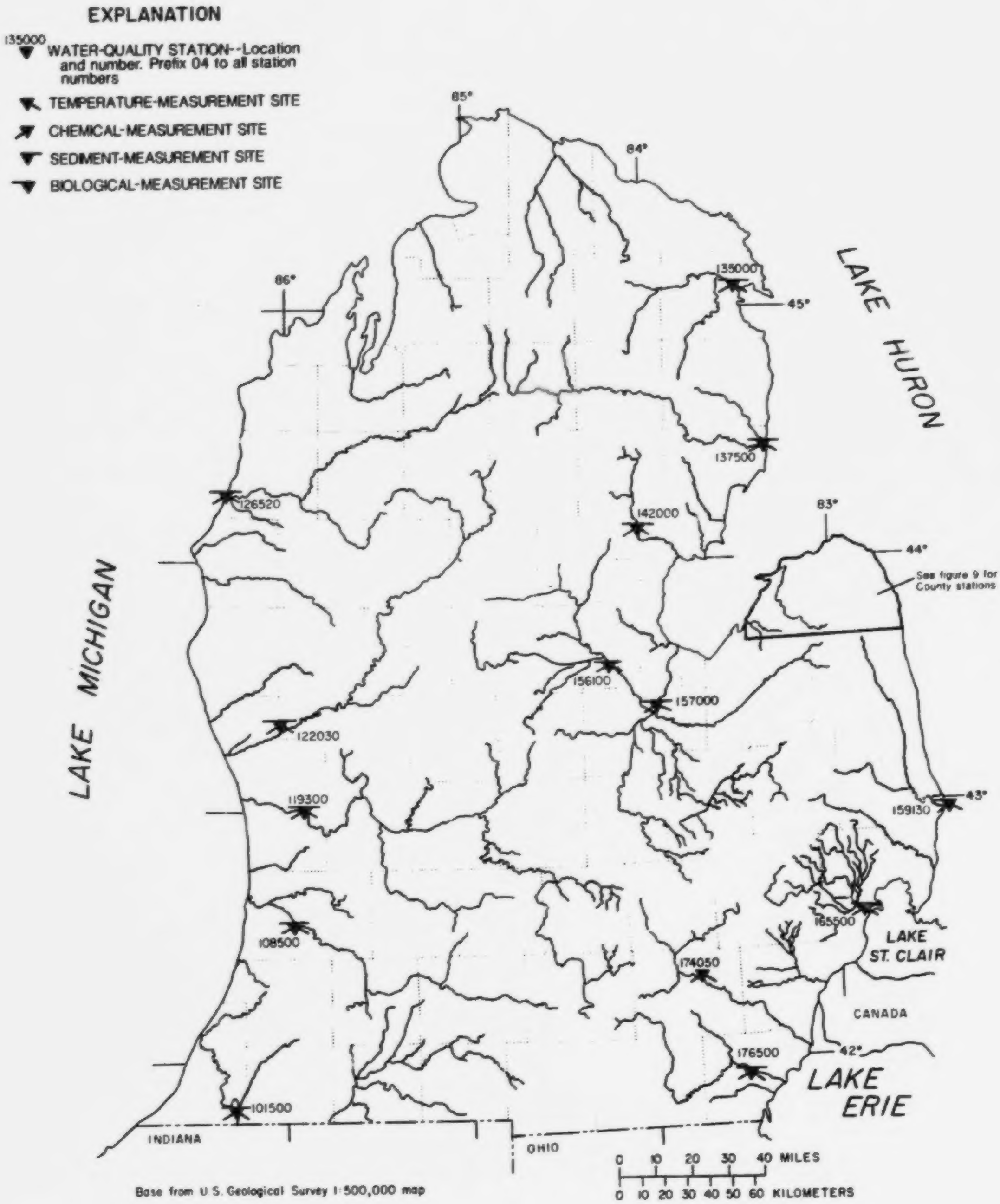

EXPLANATION
135000 WATER-QUALITY STATION--Location and number. Prefix 04 to all station numbers
TEMPERATURE-MEASUREMENT SITE
CHEMICAL-MEASUREMENT SITE
SEDIMENT-MEASUREMENT SITE
BIOLOGICAL-MEASUREMENT SITE
85°
84°
86°
45°
83°
44°
43°
42°
LAKE HURON
LAKE MICHIGAN
135000
137500
126520
142000
See figure 9 for Huron County stations
156100
157000
122030
119300
159130
165500
LAKE ST. CLAIR
108500
174050
CANADA
176500
LAKE ERIE
101500
INDIANA
OHIO
0 10 20 30 40 MILES
0 10 20 30 40 50 60 KILOMETERS
Base from U.S. Geological Survey 1:500,000 map

Figure 7.--Identification number and location of active surface-water-quality stations in the Lower Peninsula of Michigan.

04001000 WASHINGTON CREEK AT WINDIGO, MI
(Hydrologic bench-mark station)

LOCATION.--Lat 47°55'23", long 89°08'42", in NW1/4 sec.28, T.64 N., R.38 W., Keweenaw County, Isle Royale National Park, Hydrologic Unit 04020300, on left bank 0.8 mi northeast of Windigo, and 35 mi southwest of Rock Harbor.

DRAINAGE AREA.--13.2 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1964 to current year.

GAGE.--Water-stage recorder and concrete control. Elevation of gage is 605 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Oct. 1-3, 6, Dec. 8, 9, Jan. 2 to Feb. 13, Mar. 25 to Apr. 9, and Apr. 18-20. Water-discharge records good except for estimated daily discharges, which are fair.

AVERAGE DISCHARGE.--25 years, 17.0 ft³/s, 17.49 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 480 ft³/s, May 1, 1972, gage height, 6.82 ft, from rating curve extended above 160 ft³/s based on runoff characteristics of nearby stations; maximum gage height, 6.88 ft, Jan. 13, 1975, backwater from ice; minimum daily discharge, 0.44 ft³/s, Aug. 25, 1977; minimum gage height, 2.54 ft, July 28, 1988.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 110 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Nov. 16	1600	*302	*5.92	May 5	1300	115	4.43
Apr. 24	2200	142	4.67	June 13	1500	206	5.23
Apr. 27	2200	160	4.84				

Minimum discharge, 0.93 ft³/s, Aug. 18, 19, gage height, 2.67 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.7	13	18	5.7	4.8	3.6	12	85	22	10	1.5	2.9
2	4.1	12	16	5.3	4.7	3.5	8.4	83	19	9.5	2.1	2.3
3	4.8	11	16	5.4	4.6	3.4	9.6	91	21	8.3	1.9	2.0
4	7.8	11	14	5.2	4.5	3.4	18	97	20	7.1	1.8	6.5
5	7.3	12	13	5.2	4.3	3.4	38	104	17	6.8	1.6	11
6	6.5	14	13	5.1	4.2	3.4	42	76	16	6.2	1.8	7.4
7	6.0	14	12	5.4	4.1	3.4	35	61	16	5.7	1.6	5.9
8	5.6	13	9.6	5.2	4.0	3.3	29	63	18	5.3	1.4	5.2
9	5.4	15	8.0	5.2	4.0	3.2	26	57	17	5.1	1.4	4.2
10	5.0	19	6.5	5.2	3.9	3.2	24	51	15	4.9	1.3	4.2
11	4.6	19	5.7	5.4	4.0	3.5	21	44	14	4.5	1.4	4.2
12	4.3	19	5.6	5.4	4.0	3.3	19	39	17	4.0	1.5	3.4
13	4.2	36	6.3	5.4	4.1	3.4	19	36	161	3.8	1.3	2.8
14	4.0	36	6.3	5.2	4.4	3.4	23	35	123	3.7	1.3	2.8
15	3.8	33	6.3	5.0	4.4	3.4	27	35	62	3.4	1.4	2.0
16	8.5	230	6.0	5.2	4.3	3.4	43	32	40	3.3	1.2	1.9
17	23	158	5.8	5.2	4.2	3.4	67	27	29	3.0	1.1	1.8
18	16	85	5.7	5.0	4.1	3.3	65	24	23	2.8	1.0	1.7
19	13	65	5.7	5.0	4.1	3.1	65	22	21	2.7	1.1	1.6
20	11	68	5.7	5.1	3.9	3.0	67	41	17	2.4	3.7	2.4
21	12	48	5.8	5.0	3.8	3.0	74	53	14	2.3	2.8	3.5
22	10	37	5.8	4.8	3.6	2.9	103	37	13	2.0	3.9	3.5
23	14	31	6.0	5.1	3.6	2.9	102	28	14	2.0	3.4	2.7
24	31	28	6.5	5.1	3.6	2.9	110	24	14	1.8	2.8	2.3
25	24	29	6.5	5.2	3.6	3.0	136	32	13	1.7	2.5	1.9
26	19	29	6.4	5.2	3.6	3.5	126	45	17	1.7	2.3	1.9
27	16	34	6.0	5.2	3.6	7.6	143	33	16	3.2	2.4	1.9
28	19	30	6.2	5.1	3.6	17	136	25	13	2.4	2.1	1.7
29	16	26	5.9	5.1	---	26	115	25	11	1.9	4.0	1.8
30	13	20	5.7	5.1	---	26	94	30	10	1.6	3.0	1.6
31	12	---	5.7	5.0	---	18	---	25	---	1.9	2.6	---
TOTAL	335.6	1195	251.7	160.7	113.6	179.8	1797.0	1480	823	125.0	63.2	99.0
MEAN	10.8	39.8	8.12	5.18	4.06	5.80	59.9	47.7	27.4	4.03	2.04	3.30
MAX	31	230	18	5.7	4.8	26	143	104	161	10	4.0	11
MIN	3.8	11	5.6	4.8	3.6	2.9	8.4	22	10	1.6	1.0	1.6
CFSM	.82	3.02	.62	.39	.31	.44	4.54	3.61	2.08	.31	.16	.25
IN.	.95	3.37	.71	.45	.32	.51	5.06	4.17	2.32	.35	.18	.28

	TOTAL	MEAN	MAX	MIN	CFSM	IN
CAL YR 1988	5188.98	14.2	230	.68	1.08	14.62
WTR YR 1989	6623.60	18.1	230	1.0	1.37	18.67

04001000 WASHINGTON CREEK AT WINDIGO, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1965 to current year.

PERIOD OF DAILY RECORD.--
WATER TEMPERATURE: October 1964 to current year.

INSTRUMENTATION.--Water temperature recorder since Oct. 20, 1964. Digital recorder set for one-hour interval punches.

REMARKS.--Quarterly samples were collected at or near gage.

EXTREMES FOR PERIOD OF DAILY RECORD.--
WATER TEMPERATURE (water years 1966-72, 1974-89): Maximum, 24.5°C, July 8, 1987; minimum, 0.0°C on many days during winter.

EXTREMES FOR CURRENT YEAR.--
WATER TEMPERATURE: Maximum, 22.0°C, July 25, 26, Aug. 4; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
OCT										
26...	1430	19	93	7.51	3.0	2.0	12.6	96	72	K10
MAR										
02...	1430	3.8	163	7.45	0.0	1.4	13.8	96	K4	K3
APR										
26...	0945	97	57	7.29	0.0	1.9	14.1	98	44	K5
SEP										
06...	1150	7.5	139	7.95	13.0	1.6	9.5	92	76	210

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
OCT										
26...	49	8	13	4.1	2.2	9	0.1	0.5	50	0
MAR										
02...	79	7	21	6.5	3.8	9	0.2	0.6	88	0
APR										
26...	30	10	7.7	2.6	1.3	8	0.1	0.5	24	0
SEP										
06...	76	10	21	5.8	3.0	8	0.2	0.6	80	0

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
OCT										
26...	41	12	2.2	0.1	12	101	0.14	5.18	<0.01	<0.10
MAR										
02...	72	11	3.4	0.1	16	117	0.16	1.20	0.01	0.10
APR										
26...	20	--	0.80	0.1	9.5	65	0.09	17.0	0.01	<0.10
SEP										
06...	66	--	2.1	0.1	14	111	0.15	2.25	<0.01	<0.10

04001000 WASHINGTON CREEK AT WINDIGO, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
OCT 26...	0.03	0.05	0.60	0.01	0.01	<0.01	40	<1	8	<0.5
MAR 02...	0.02	0.02	0.40	<0.01	<0.01	<0.01	30	<1	9	<0.5
APR 26...	0.05	0.04	0.50	0.02	0.01	<0.01	100	<1	7	<0.5
SEP 06...	0.04	0.02	0.90	0.01	0.01	0.02	30	<1	10	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
OCT 26...	<1	<1	<3	3	260	<5	<4	9	<0.1	<10
MAR 02...	<1	<1	4	<1	530	<5	6	17	<0.1	<10
APR 26...	<1	<1	10	2	220	<5	<4	7	<0.1	<10
SEP 06...	<1	<1	<3	5	350	<1	<4	13	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	GROSS ALPHA, DISSOLVED (UG/L AS U-NAT)	GROSS ALPHA, SUSP. TOTAL (UG/L AS U-NAT)	GROSS BETA, DISSOLVED (PCI/L AS CS-137)	GROSS BETA, SUSP. TOTAL (PCI/L AS CS-137)
OCT 26...	1	<1	<1.0	24	<6	21	<0.4	<0.4	1.5	<0.4
MAR 02...	<1	<1	<1.0	44	<6	5	--	--	--	--
APR 26...	3	<1	3.0	15	<6	15	0.7	<0.4	1.2	0.5
SEP 06...	<1	<1	<1.0	40	<6	18	--	--	--	--

DATE	GROSS BETA, DISSOLVED (PCI/L AS SR/YT-90)	GROSS BETA, SUSP. TOTAL (PCI/L AS SR/YT-90)	RADIUM 226, DISSOLVED, RADON METHOD (PCI/L)	URANIUM NATURAL DISSOLVED (UG/L AS U)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
OCT 26...	1.3	<0.4	0.03	0.03	5	0.26	75
MAR 02...	--	--	--	--	9	0.09	70
APR 26...	1.1	0.5	<0.02	<0.01	18	4.7	63
SEP 06...	--	--	--	--	4	0.08	86

04001000 WASHINGTON CREEK AT WINDIGO, MI--Continued

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
		OCTOBER			NOVEMBER			DECEMBER			JANUARY	
1	12.0	11.0	11.5	1.0	1.0	1.0	.0	.0	.0	.0	.0	.0
2	11.5	10.0	10.5	1.0	.5	1.0	.0	.0	.0	.0	.0	.0
3	9.5	7.5	8.5	1.5	.5	1.0	.0	.0	.0	.0	.0	.0
4	8.0	6.5	7.0	2.0	1.5	2.0	.0	.0	.0	.0	.0	.0
5	6.5	6.0	6.5	2.0	.5	1.0	.0	.0	.0	.0	.0	.0
6	6.5	5.0	5.5	1.0	.0	.5	.0	.0	.0	.0	.0	.0
7	7.0	5.0	6.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
8	7.5	5.0	6.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
9	6.5	5.0	5.5	.5	.0	.0	.0	.0	.0	.0	.0	.0
10	8.0	6.5	7.0	.5	.5	.5	.0	.0	.0	.0	.0	.0
11	7.0	5.0	5.5	.5	.5	.5	.0	.0	.0	.0	.0	.0
12	4.5	3.5	4.0	.5	.5	.5	.0	.0	.0	.0	.0	.0
13	3.5	1.5	3.0	1.0	.5	.5	.0	.0	.0	.0	.0	.0
14	5.5	3.0	4.0	1.5	1.0	1.0	.0	.0	.0	.0	.0	.0
15	6.5	3.5	5.0	1.5	1.0	1.5	.0	.0	.0	.0	.0	.0
16	7.5	6.0	6.5	1.0	.0	.5	.0	.0	.0	.0	.0	.0
17	7.5	6.5	7.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
18	6.5	5.5	6.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
19	5.5	5.0	5.5	.0	.0	.0	.0	.0	.0	.0	.0	.0
20	5.0	3.5	4.5	.0	.0	.0	.0	.0	.0	.0	.0	.0
21	5.5	5.0	5.5	.0	.0	.0	.0	.0	.0	.0	.0	.0
22	5.0	4.5	4.5	.0	.0	.0	.0	.0	.0	.0	.0	.0
23	4.5	4.5	4.5	.0	.0	.0	.0	.0	.0	.0	.0	.0
24	5.0	5.0	5.0	.5	.0	.0	.0	.0	.0	.0	.0	.0
25	5.0	4.0	4.5	1.0	.5	.5	.0	.0	.0	.0	.0	.0
26	4.0	3.0	3.5	.5	.0	.5	.0	.0	.0	.0	.0	.0
27	3.0	2.5	2.5	.5	.0	.0	.0	.0	.0	.0	.0	.0
28	2.5	2.0	2.5	.0	.0	.0	.0	.0	.0	.0	.0	.0
29	2.0	1.0	1.5	.0	.0	.0	.0	.0	.0	.0	.0	.0
30	2.0	.5	1.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
31	1.0	.5	1.0	---	---	---	.0	.0	.0	.0	.0	.0
MONTH	12.0	.5	5.0	2.0	.0	.5	.0	.0	.0	.0	.0	.0

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
		FEBRUARY			MARCH			APRIL			MAY	
1	.0	.0	.0	.0	.0	.0	.0	.0	.0	3.0	.5	1.5
2	.0	.0	.0	.0	.0	.0	.0	.0	.0	5.0	2.0	3.0
3	.0	.0	.0	.0	.0	.0	.0	.0	.0	6.0	3.0	4.5
4	.0	.0	.0	.0	.0	.0	.0	.0	.0	6.0	3.5	4.5
5	.0	.0	.0	.0	.0	.0	.0	.0	.0	5.0	1.0	3.0
6	.0	.0	.0	.0	.0	.0	.0	.0	.0	1.0	.0	.5
7	.0	.0	.0	.0	.0	.0	.0	.0	.0	4.0	.5	2.0
8	.0	.0	.0	.0	.0	.0	.0	.0	.0	6.5	2.0	4.0
9	.0	.0	.0	.0	.0	.0	.0	.0	.0	7.0	3.5	5.0
10	.0	.0	.0	.0	.0	.0	.0	.0	.0	8.0	4.5	6.0
11	.0	.0	.0	.0	.0	.0	.0	.0	.0	8.5	4.5	6.5
12	.0	.0	.0	.0	.0	.0	.0	.0	.0	9.5	5.0	7.0
13	.0	.0	.0	.0	.0	.0	.0	.0	.0	10.5	7.0	8.5
14	.0	.0	.0	.0	.0	.0	.0	.0	.0	9.0	8.0	8.5
15	.0	.0	.0	.0	.0	.0	.0	.0	.0	11.0	7.0	9.0
16	.0	.0	.0	.0	.0	.0	.0	.0	.0	13.0	8.5	10.5
17	.0	.0	.0	.0	.0	.0	.0	.0	.0	14.5	10.0	12.0
18	.0	.0	.0	.0	.0	.0	.0	.0	.0	12.5	11.5	12.0
19	.0	.0	.0	.0	.0	.0	.0	.0	.0	14.0	11.0	12.5
20	.0	.0	.0	.0	.0	.0	.0	.0	.0	12.5	10.5	11.5
21	.0	.0	.0	.0	.0	.0	1.0	.0	.0	13.0	9.0	11.0
22	.0	.0	.0	.0	.0	.0	1.0	.0	.0	14.0	10.5	12.0
23	.0	.0	.0	.0	.0	.0	1.5	.0	.5	14.0	12.0	13.0
24	.0	.0	.0	.0	.0	.0	2.0	.0	.5	13.0	11.0	12.0
25	.0	.0	.0	.0	.0	.0	.5	.0	.5	13.5	10.0	11.5
26	.0	.0	.0	.0	.0	.0	2.5	.0	1.0	12.5	11.0	12.0
27	.0	.0	.0	.0	.0	.0	3.0	.0	1.5	13.0	9.0	11.0
28	.0	.0	.0	.0	.0	.0	3.0	.0	1.5	12.0	9.5	11.0
29	---	---	---	.0	.0	.0	2.0	1.0	2.0	11.0	9.0	10.0
30	---	---	---	.0	.0	.0	2.0	.5	1.5	11.0	7.0	9.0
31	---	---	---	.0	.0	.0	---	---	---	13.5	9.5	11.0
MONTH	.0	.0	.0	.0	.0	.0	3.0	.0	.5	14.5	.0	8.0

04001000 WASHINGTON CREEK AT WINDIGO, MI--Continued

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
		JUNE			JULY			AUGUST			SEPTEMBER	
1	15.0	10.5	12.5	16.0	13.0	14.0	18.5	15.0	16.5	14.5	12.0	13.0
2	13.5	11.5	12.5	18.0	14.0	16.0	21.0	16.5	18.5	14.5	10.5	12.5
3	14.0	10.0	12.0	21.0	16.0	18.0	21.0	17.5	19.0	14.0	10.5	12.5
4	14.0	11.0	12.0	20.5	15.5	18.0	22.0	18.0	19.5	13.5	13.0	13.5
5	12.0	9.5	10.5	19.0	15.5	17.5	20.5	17.0	18.5	14.0	12.0	13.0
6	14.0	9.0	11.5	21.0	16.0	18.5	17.5	13.5	15.5	15.5	12.5	13.0
7	12.5	9.5	11.0	20.5	16.0	18.0	16.5	12.5	14.5	16.5	14.5	15.5
8	9.5	7.5	8.5	18.5	14.0	16.5	18.0	13.5	15.5	16.5	14.0	15.0
9	12.0	7.5	9.5	17.5	15.5	16.5	17.5	13.5	15.5	14.5	13.5	14.0
10	13.5	8.5	11.0	19.5	15.0	17.0	19.0	14.0	16.5	14.0	11.5	13.0
11	15.0	10.0	12.5	18.5	15.5	17.0	20.0	15.5	17.5	13.0	12.0	12.5
12	13.5	11.0	12.5	17.0	14.0	15.5	19.5	15.5	17.5	12.5	10.5	11.5
13	10.5	9.0	9.5	18.5	14.0	16.0	18.0	16.0	17.0	11.5	8.5	10.0
14	11.5	8.5	10.0	18.0	13.5	15.5	17.0	14.5	15.5	11.0	8.0	9.5
15	12.5	9.5	11.0	17.0	12.0	14.5	17.5	13.5	15.0	11.5	8.5	10.0
16	13.5	10.5	12.0	15.5	13.5	14.5	17.0	12.5	14.5	12.0	8.5	10.5
17	14.5	11.0	13.0	17.0	13.0	14.5	16.0	11.5	13.5	13.0	9.5	11.5
18	14.0	12.5	13.0	17.0	13.5	15.5	17.5	12.0	14.5	14.5	11.0	13.0
19	16.5	12.0	14.0	18.5	14.0	16.0	16.5	14.0	15.0	14.5	13.5	14.0
20	18.5	13.5	15.5	19.0	14.0	16.5	16.5	15.0	15.5	14.0	13.0	13.5
21	19.0	15.5	17.0	18.5	14.0	16.5	16.0	14.0	15.0	14.5	13.5	14.0
22	17.0	16.0	16.5	19.0	14.5	16.5	14.5	14.0	14.0	14.0	10.0	13.0
23	16.0	15.0	15.5	20.5	14.5	17.5	16.5	13.5	14.5	9.5	8.0	8.5
24	17.5	13.0	15.0	21.0	16.0	18.5	15.5	12.5	14.0	9.5	6.5	8.0
25	16.0	14.5	15.5	22.0	17.0	19.5	15.0	11.0	13.0	9.5	8.0	9.0
26	15.5	14.0	14.5	22.0	17.5	20.0	15.5	13.0	14.5	8.5	7.0	7.5
27	16.0	13.0	14.5	20.0	18.0	19.0	17.5	14.5	15.5	8.5	4.5	6.5
28	16.0	13.0	14.5	19.0	15.0	17.0	16.5	13.5	15.0	10.5	8.5	9.5
29	13.5	11.0	12.5	16.5	13.5	15.0	16.5	14.5	15.5	10.0	8.0	9.0
30	14.0	12.5	13.0	15.5	14.0	15.0	16.5	14.0	15.5	10.5	8.0	9.5
31	---	---	---	18.5	14.5	16.0	14.5	13.5	14.0	---	---	---
MONTH	19.0	7.5	13.0	22.0	12.0	16.5	22.0	11.0	15.5	16.5	4.5	11.5

04033000 MIDDLE BRANCH ONTONAGON RIVER NEAR PAULDING, MI

LOCATION.--Lat 46°21'25", long 89°04'38", in SE1/4 NE1/4 sec.29, T.46 N., R.38 W., Ontonagon County, Hydrologic Unit 04020102, Ottawa National Forest, on right bank 25 ft downstream from bridge on Forest Service Road 172, 2.4 mi upstream from Bond Falls Reservoir, and 5.7 mi southeast of Paulding.

DRAINAGE AREA.--164 mi².

PERIOD OF RECORD.--June 1942 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,485.66 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Sept. 28, 1942, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 2 to Mar. 28. Records excellent except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--47 years, 174 ft³/s, 14.41 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,050 ft³/s, Apr. 30, 1951, gage height, 10.0 ft, from floodmark; minimum, 27 ft³/s, Nov. 22, 1946, result of freezeup; minimum gage height, 2.96 ft, Nov. 26, 1942, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 697 ft³/s, Nov. 18, gage height, 6.74 ft; minimum, 64 ft³/s, Aug. 11, 12, gage height, 3.49 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	108	150	263	130	120	98	216	313	216	143	96	174
2	104	145	235	125	120	98	210	284	212	134	91	145
3	100	143	260	125	120	98	244	260	206	124	87	114
4	124	148	200	120	115	98	289	236	194	118	85	103
5	145	235	240	120	115	98	322	236	169	112	81	114
6	134	263	210	120	110	97	314	233	159	107	77	111
7	126	245	180	120	110	98	308	218	157	103	75	108
8	116	226	165	120	110	99	313	208	387	100	72	132
9	110	214	150	120	110	100	289	196	566	99	75	118
10	106	220	140	120	110	100	266	183	465	98	75	107
11	104	220	135	115	105	100	250	174	349	94	69	100
12	110	205	135	115	105	105	237	166	285	93	69	99
13	104	198	140	115	105	105	222	160	304	90	81	99
14	99	198	150	120	105	105	237	163	326	97	104	98
15	98	201	150	120	105	100	268	167	294	89	113	90
16	102	478	150	120	100	98	311	165	258	81	109	83
17	115	663	145	120	100	96	424	157	228	82	95	82
18	122	673	145	120	100	94	461	150	211	81	87	82
19	120	547	150	120	98	92	441	163	195	90	80	84
20	117	440	155	120	98	90	420	190	176	80	93	83
21	117	374	160	120	98	88	402	210	161	75	102	82
22	122	332	160	120	98	88	397	177	151	79	103	80
23	125	298	160	120	98	90	388	163	154	75	101	79
24	153	271	160	120	99	105	382	167	154	78	93	79
25	190	261	155	120	99	160	378	247	143	77	88	77
26	192	256	150	120	98	225	390	257	140	77	84	76
27	190	282	145	120	98	340	367	217	160	91	83	75
28	203	317	140	120	98	330	331	187	141	120	80	75
29	185	311	140	120	---	292	297	173	127	102	85	76
30	164	289	135	120	---	261	302	191	128	104	78	74
31	151	---	130	120	---	237	---	220	---	102	115	---
TOTAL	4056	8803	5133	3725	2947	4185	9676	6231	6818	2995	2726	2899
MEAN	131	293	166	120	105	135	323	201	227	96.6	87.9	96.6
MAX	203	673	263	130	120	340	461	313	568	143	115	174
MIN	98	143	130	115	98	88	210	150	127	75	69	74
CFSM	.80	1.79	1.01	.73	.64	.82	1.97	1.23	1.38	.59	.54	.59
IN.	.92	2.00	1.16	.84	.67	.95	2.19	1.41	1.55	.68	.62	.66

CAL YR 1988 TOTAL 57467 MEAN 157 MAX 875 MIN 66 CFSM .96 IN 13.04
WTR YR 1989 TOTAL 60194 MEAN 165 MAX 673 MIN 69 CFSM 1.01 IN 13.65

04033500 BOND FALLS CANAL NEAR PAULDING, MI

LOCATION.--Lat 46°23'57", long 89°08'47", in SW1/4 NE1/4 sec.11, T.46 N., R.39 W., Ontonagon County, Hydrologic Unit 04020102, on left bank 40 ft upstream from intake to pipeline No. 2, 0.8 mi downstream from Bond Falls Reservoir on Middle Branch Ontonagon River, and 1.6 mi east of Paulding.

PERIOD OF RECORD.--July 1942 to current year.

GAGE.--Water-stage recorder and concrete control. Datum of gage is 1,441.59 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 1, 1968, nonrecording gage at datum 3.00 ft higher.

REMARKS.--Estimated daily discharges: Feb. 3-5, 16, 18, Mar. 1, 2, 6, 19, Apr. 11, 12, and June 20-27. Records excellent except those below 5.0 ft^3/s, which are poor. Canal diverts water from Bond Falls Reservoir (station 04034000) to South Branch Ontonagon River; water is used for power production at Victoria Dam near Rockland. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--47 years, 142 ft^3/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 368 ft^3/s, May 5, 1960; no flow for several days in 1963-70, 1973-75, 1982, 1987

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	103	8.5	13	257	239	239	4.8	36	7.2	13	118	75
2	102	8.5	55	248	238	220	4.8	8.2	27	13	118	75
3	102	8.5	116	251	237	215	4.8	8.5	58	79	117	74
4	102	8.7	113	252	236	206	4.8	8.0	59	159	118	75
5	102	9.2	122	252	235	183	4.8	34	59	159	116	75
6	102	9.0	149	263	234	195	4.8	66	97	159	116	75
7	102	9.0	167	266	227	206	4.8	57	122	158	115	101
8	102	9.0	163	262	222	209	4.8	34	168	157	116	143
9	102	9.0	195	252	225	212	4.8	8.7	296	157	97	153
10	102	9.0	253	252	225	214	4.8	8.7	298	219	77	153
11	101	9.2	250	247	230	217	5.2	8.5	299	298	76	177
12	101	9.4	279	247	229	220	5.6	19	165	303	76	205
13	101	9.5	310	249	227	223	5.7	44	213	302	76	205
14	102	9.4	309	260	223	223	5.9	45	336	301	76	207
15	102	9.9	305	257	217	222	6.3	32	316	299	75	206
16	102	12	303	254	228	222	6.4	9.9	314	299	76	206
17	101	10	301	251	231	222	6.5	9.7	313	298	75	206
18	101	10	298	251	253	214	5.7	9.9	311	261	75	163
19	101	11	300	256	253	185	4.5	25	309	212	75	114
20	101	11	268	255	253	168	3.6	56	310	210	76	87
21	100	11	246	255	254	134	1.1	58	310	209	75	63
22	101	11	279	256	248	104	.42	44	310	209	76	55
23	101	12	277	255	226	65	.30	7.8	173	208	75	54
24	62	12	300	253	241	7.6	.30	7.2	62	208	75	54
25	8.6	12	318	251	244	6.4	.50	7.2	9.0	163	75	54
26	8.5	12	318	250	233	6.0	.90	7.2	12	119	75	54
27	8.5	12	317	250	234	5.6	.41	7.2	13	119	75	55
28	8.1	13	282	250	246	5.6	25	7.2	13	118	75	55
29	7.8	13	248	246	---	4.8	67	7.2	97	117	75	55
30	8.2	13	262	243	---	4.8	55	7.2	98	117	74	55
31	8.4	---	258	242	---	4.8	---	7.2	---	118	75	---
TOTAL	2456.1	310.8	7374	7833	6588	4563.6	254.33	695.5	5174.2	5761	2689	3329
MEAN	79.2	10.4	238	253	235	147	8.48	22.4	172	186	86.7	111
MAX	103	13	318	266	254	239	67	66	336	303	118	207
MIN	7.8	8.5	13	242	217	4.8	.30	7.2	7.2	13	74	54

CAL YR 1988 TOTAL 44457.90 MEAN 121 MAX 328 MIN 2.3
WTR YR 1989 TOTAL 47028.53 MEAN 129 MAX 336 MIN .30

04034000 BOND FALLS RESERVOIR NEAR PAULDING, MI

LOCATION.--Lat 46°24'29", long 89°07'42", in SW1/4 sec.1, T.46 N., R.39 W., Ontonagon County, Hydrologic Unit 04020102, at Bond Falls Dam on Middle Branch Ontonagon River, 2.5 mi east of Paulding.

DRAINAGE AREA.--190 mi^2.

PERIOD OF RECORD.--June 1942 to current year. Prior to October 1950, monthend contents only published in WSP 1307.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Nonrecording gage read once daily. Datum of gage is 1,335.59 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Reservoir is formed by earthfill and concrete dam with one taintor gate; dam completed in 1937. Capacity of reservoir, 41,300 acre-ft between gage heights of 120 ft (maximum drawdown) and 141 ft (full pond). Dead storage unknown. Water diverted to South Branch Ontonagon River through Bond Falls Canal (station 04033500); water used for power production at Victoria Dam near Rockland.

COOPERATION.--Gage-height record provided by Upper Peninsula Power Co. and converted to acre-feet by U.S. Geological Survey.

EXTREMES FOR PERIOD OF RECORD (SINCE 1947).--Maximum contents observed, 42,980 acre-ft, July 3, 1953, gage height, 141.7 ft, of which 1,680 acre-ft was uncontrolled storage; no usable storage at times; minimum gage height observed, 116.0 ft, Mar. 21, 1970.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 37,980 acre-ft, June 10, 11, 13, gage height, 139.6 ft; minimum, 4,320 acre-ft, Mar. 21-23, gage height, 122.8 ft.

MONTHEND GAGE HEIGHT AND CONTENTS AT 1030, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

Date	Gage height (feet)	Contents (acre-feet)	Change in contents (acre-feet)	Change in contents (equivalent in ft^3/s)
Sept. 30	131.2	19,900	--	--
Oct. 31	132.1	21,700	+1,800	+29.3
Nov. 30	139.0	36,600	+14,900	+250
Dec. 31	135.8	29,360	-7,240	-118
CAL YR 1988	--	--	0	0.0
Jan. 31	131.0	19,500	-9,860	-160
Feb. 28	126.2	10,380	-9,120	-164
Mar. 31	124.9	8,020	-2,360	-38.4
Apr. 30	134.3	26,130	+18,110	+304
May 31	138.1	34,530	+8,400	+137
June 30	137.6	33,380	-1,150	-19.3
July 31	133.6	24,700	-8,680	-141
Aug. 31	132.5	22,500	-2,200	-35.8
Sept. 30	131.4	20,300	-2,200	-37.0
WTR YR 1989	--	--	+400	+0.6

04034500 MIDDLE BRANCH ONTONAGON RIVER NEAR TROUT CREEK, MI

LOCATION.--Lat 46°28'40", long 89°05'25", in SW1/4 sec.8, T.47 N., R.38 W., Ontonagon County, Hydrologic Unit 04020102, on right bank 0.1 mi upstream from State Highway 28, 3.8 mi west of village of Trout Creek, and 7.5 mi downstream from Bond Falls Reservoir.

DRAINAGE AREA.--203 mi².

PERIOD OF RECORD.--June 1942 to current year.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,132.03 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Nov. 4, 1942, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 15, 16, 29, 30, Jan. 9-12, Feb. 3-9, 16-19, and Mar. 1, 2, 6, 7, 18, 19, 21, 22. Records excellent except for estimated daily discharges, which are good. Flow regulated by Bond Falls Reservoir (station 04034000) 7.5 mi upstream. Diversion to South Branch Ontonagon River 8.5 mi upstream by Bond Falls Canal (station 04033500). Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--47 years, 65.3 ft³/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,750 ft³/s, Nov. 7, 1951, gage height, 5.05 ft; minimum, 14 ft³/s, sometime during period Jan. 23 to Feb. 13, 1947, gage height, 1.14 ft, from recorded range in stage, caused by ice jams upstream.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 310 ft³/s, June 13, 14, gage height, 2.79 ft; minimum daily, 41 ft³/s, Feb. 2, Mar. 8, 9.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	43	46	50	48	42	42	52	59	60	53	49	54
2	43	45	53	48	41	44	55	56	63	52	49	43
3	43	45	52	46	46	44	59	55	62	52	49	43
4	48	48	49	46	46	42	64	54	60	52	49	45
5	46	60	54	47	45	43	65	55	60	52	49	43
6	45	57	52	47	45	42	61	55	60	52	48	44
7	44	55	51	47	44	42	59	54	62	52	48	45
8	44	55	46	45	44	41	59	54	189	51	50	45
9	43	57	47	46	44	41	54	54	98	52	50	45
10	43	60	47	46	44	42	52	54	70	52	51	45
11	44	57	51	46	44	44	52	52	63	51	55	45
12	43	55	52	46	44	44	51	52	108	50	54	45
13	43	55	52	45	44	44	52	52	255	49	55	45
14	43	55	51	45	42	43	57	52	304	49	54	44
15	43	58	49	46	44	44	61	52	293	49	53	44
16	45	140	51	45	43	45	70	52	286	50	52	44
17	45	73	51	45	43	45	78	52	279	49	51	44
18	46	59	49	46	43	46	62	54	275	49	51	43
19	45	57	49	46	43	45	59	57	195	49	51	44
20	43	55	51	45	42	44	59	60	56	49	63	44
21	43	53	51	46	42	45	58	59	55	49	52	44
22	43	52	51	47	42	45	58	57	55	49	53	44
23	48	52	50	46	42	45	57	57	56	49	52	44
24	62	52	49	45	42	45	57	58	55	49	52	44
25	55	52	45	45	42	47	62	68	55	49	52	44
26	49	53	48	46	42	51	65	61	55	48	52	44
27	51	58	48	45	43	62	58	58	55	53	52	44
28	51	58	48	45	42	61	56	58	53	49	52	44
29	47	54	48	45	---	58	55	59	52	50	52	44
30	46	54	48	45	---	57	59	60	55	49	52	44
31	46	---	48	45	---	54	---	61	---	49	63	---
TOTAL	1423	1730	1541	1421	1210	1437	1766	1741	3444	1557	1615	1334
MEAN	45.9	57.7	49.7	45.8	43.2	46.4	58.9	56.2	115	50.2	52.1	44.5
MAX	62	140	54	48	46	62	78	68	304	53	63	54
MIN	43	45	45	45	41	41	51	52	52	48	48	43

CAL YR 1988 TOTAL 18864 MEAN 51.5 MAX 140 MIN 43
WTR YR 1989 TOTAL 20219 MEAN 55.4 MAX 304 MIN 41

04035500 MIDDLE BRANCH ONTONAGON RIVER NEAR ROCKLAND, MI

LOCATION.--Lat 46°41'57", long 89°09'36", in SE1/4 sec.27, T.50 N., R.39 W., Ontonagon County, Hydrologic Unit 04020102, on left bank 10 ft upstream from bridge on U.S. Highway 45, 700 ft downstream from East Branch, and 2.8 mi southeast of Rockland.

DRAINAGE AREA.--671 mi².

PERIOD OF RECORD.--July 1942 to current year.

GAGE.--Water-stage recorder. Datum of gage is 661.1 ft above National Geodetic Vertical Datum of 1929. Prior to Apr. 1, 1959, nonrecording gage at site 400 ft upstream at same datum. Apr. 1, 1959 to Oct. 21, 1968, nonrecording gage at present site and datum.

REMARKS.--Estimated daily discharges: Dec. 9 to Mar. 28. Records good except for estimated daily discharges, which are fair. Regulation by Bond Fall Reservoir (station 04034000) 30.0 mi upstream. Diversion to South Branch Ontonagon River by Bond Falls Canal (station 04033500) 31.0 mi upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE--47 years, 527 ft³/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 27,000 ft³/s, Aug. 22, 1942, gage height, 21.2 ft, from floodmarks, from rating curve extended above 7,500 ft³/s, on basis of slope-area measurement of peak flow; minimum observed, 142 ft³/s, Dec. 3, 1963, discharge measurement; minimum daily, 145 ft³/s, Dec. 3, 1963.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 8,350 ft³/s, Nov. 16, gage height, 11.87 ft; minimum, 190 ft³/s, Aug. 9-12, gage height, 3.45 ft; minimum daily, 190 ft³/s, Aug. 10, 11.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	229	489	372	305	285	265	1050	1110	331	584	234	306
2	221	478	361	300	270	260	1010	741	320	358	222	279
3	216	435	394	300	260	250	1890	561	305	296	201	241
4	266	587	343	295	255	250	2780	471	284	267	199	222
5	343	2120	334	290	250	255	2170	460	265	253	198	222
6	311	1870	360	290	260	255	1800	468	260	243	196	218
7	275	1240	323	290	265	260	1530	414	253	236	193	214
8	255	1010	266	285	270	265	1500	400	3140	230	193	207
9	242	1110	240	285	275	270	917	367	4330	228	193	205
10	235	1360	225	285	275	270	755	335	1880	229	190	203
11	230	1300	215	285	275	270	644	314	1070	224	190	205
12	235	888	210	290	275	275	578	299	753	222	193	202
13	233	812	230	300	275	275	585	284	2110	220	208	200
14	227	875	285	310	275	270	1290	278	1970	217	218	201
15	226	870	290	320	270	260	1650	272	1290	216	239	201
16	235	7010	270	315	260	255	2390	268	927	216	222	200
17	345	2800	285	310	250	250	2910	259	721	216	211	200
18	377	1380	300	310	250	245	1680	240	606	218	204	199
19	348	1020	305	305	245	235	1440	236	558	222	197	197
20	329	881	320	300	245	235	1430	292	365	218	244	199
21	304	676	330	290	250	240	1320	333	314	214	251	200
22	292	489	350	300	255	240	1380	280	292	211	233	199
23	384	462	355	320	260	250	1190	252	324	208	222	196
24	1600	451	355	325	265	265	1080	254	412	213	214	195
25	1850	443	350	315	270	300	995	832	331	209	206	195
26	1040	446	350	310	270	350	1170	586	313	209	203	193
27	835	733	335	305	270	1500	978	392	387	272	203	194
28	1450	948	325	305	265	3200	729	325	310	286	199	196
29	865	630	320	305	---	2480	573	288	272	254	198	196
30	575	533	315	300	---	1870	713	287	552	244	196	195
31	471	---	310	300	---	1350	---	311	---	240	242	---
TOTAL	15044	34346	9623	9345	7390	17215	40127	12209	25245	7673	6512	6280
MEAN	485	1145	310	301	264	555	1338	394	842	248	210	209
MAX	1850	7010	394	325	285	3200	2910	1110	4330	584	251	306
MIN	216	435	210	285	245	235	573	236	253	208	190	193

CAL YR 1988 TOTAL 171633 MEAN 469 MAX 7010 MIN 170
WTR YR 1989 TOTAL 191009 MEAN 523 MAX 7010 MIN 190

04035995 LAKE GOGEBIC NEAR BERGLAND, MI

LOCATION.--Lat 46°35'19", long 89°32'52", in SW1/4 NW1/4 sec.3, T.48 N., R.42 W., Ontonagon County, Hydrologic Unit 04020102, at upstream side of dam on lake outlet, 1.0 mi southeast of Bergland, and 4.3 mi east of Merriweather.

DRAINAGE AREA.--162 mi².

PERIOD OF RECORD.--July 1958 to September 1959 (no winter record), February 1969 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,292.70 ft above National Geodetic Vertical Datum of 1929. July 1958 to September 1959, nonrecording gage at mouth of Merriweather Creek at different datum. Prior to Oct. 1, 1988, at datum 1.00 ft higher.

REMARKS.--Lake Gogebic is used as a storage reservoir (capacity 35,200 acre-ft) by Upper Peninsula Power Company for power production at Victoria Dam near Rockland. Lake level is controlled at the outlet by a concrete dam with removable flash boards. Major inlets to Lake Gogebic are Slate River, Trout Brook, and Merriweather Creek. Streamflow records are currently collected at the outlet, West Branch Ontonagon River (station 04036000). Surface area of lake is 14,780 acres.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily gage height, 4.30 ft, present datum, Apr. 22, 1971; minimum daily, 0.68 ft, present datum, Apr. 5, 6, 1970.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 3.87 ft, May 25, result of wind action; minimum, 0.89 ft, Mar. 26, result of wind action.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.85	2.86	2.95	2.57	1.76	1.22	1.26	3.03	3.44	3.23	2.81	2.75
2	2.82	2.89	2.91	2.54	1.76	1.19	1.30	3.12	3.47	3.22	2.83	2.76
3	2.84	2.88	2.89	2.52	1.74	1.18	1.34	3.18	3.43	3.17	2.82	2.76
4	2.79	2.85	2.88	2.50	1.72	1.18	1.43	3.25	3.42	3.13	2.77	2.79
5	2.86	2.87	2.87	2.46	1.69	1.18	1.54	3.30	3.41	3.10	2.79	2.79
6	2.86	2.96	2.88	2.42	1.66	1.16	1.62	3.31	3.40	3.08	2.69	2.77
7	2.84	3.05	2.85	2.40	1.63	1.15	1.67	3.35	3.38	3.03	2.69	2.78
8	2.81	3.03	2.84	2.42	1.61	1.13	1.73	3.38	3.45	3.03	2.67	2.77
9	2.81	3.00	2.84	2.40	1.59	1.12	1.76	3.41	3.45	3.00	2.66	2.75
10	2.76	2.97	---	2.37	1.57	1.10	1.79	3.43	3.46	2.95	2.66	2.74
11	2.70	2.99	2.80	2.34	1.54	1.08	1.82	3.45	3.42	2.94	2.66	2.73
12	2.70	2.97	2.79	2.33	1.52	1.07	1.82	3.45	3.38	2.93	2.65	2.73
13	2.70	2.97	2.78	2.30	1.49	1.07	1.83	3.47	3.36	2.89	2.65	2.70
14	2.69	2.93	2.79	2.27	1.47	1.07	1.87	3.47	3.35	2.89	2.69	2.70
15	2.68	2.89	2.80	2.24	1.43	1.09	1.90	3.48	3.34	2.89	2.71	2.69
16	2.70	3.16	2.77	2.22	1.42	1.08	1.99	3.49	3.28	2.88	2.70	2.68
17	2.67	3.23	2.76	2.19	1.40	1.07	2.14	3.50	3.25	2.87	2.70	2.67
18	2.67	3.19	2.75	2.19	1.37	1.06	2.27	3.46	3.20	2.86	2.71	2.71
19	2.67	3.19	2.73	2.17	1.35	1.05	2.35	3.44	3.19	2.87	2.71	2.69
20	2.68	3.17	2.76	2.15	1.33	1.03	2.43	3.45	3.23	2.86	2.75	2.64
21	2.65	3.15	2.76	2.12	1.31	1.02	2.52	3.44	3.22	2.86	2.73	2.66
22	2.65	3.11	2.73	2.06	1.29	1.01	2.60	3.43	---	2.85	2.73	2.61
23	2.67	3.06	2.74	2.03	1.28	.99	2.70	3.43	3.34	2.85	2.71	2.58
24	2.73	3.00	2.73	2.00	1.26	.98	2.79	3.43	3.34	2.86	2.70	2.64
25	2.80	2.94	2.71	1.95	1.25	.98	2.85	3.53	3.33	2.85	2.71	2.58
26	2.88	2.93	2.68	1.93	1.24	.97	2.93	3.44	3.31	2.84	2.70	2.51
27	2.92	2.97	2.69	1.87	1.23	.99	2.96	3.37	3.29	2.84	2.70	2.58
28	3.00	3.01	2.67	1.84	1.22	1.05	2.96	3.41	3.21	2.82	2.68	2.58
29	2.89	3.00	2.64	1.81	---	1.12	2.94	3.36	3.23	2.83	2.72	2.49
30	2.90	2.96	2.60	1.79	---	1.18	2.96	3.39	3.25	2.82	2.68	2.53
31	2.91	---	2.58	1.75	---	1.22	---	3.40	---	2.80	2.73	---
MEAN	2.78	3.01	---	2.20	1.47	1.09	2.14	3.39	---	2.94	2.71	2.68
MAX	3.00	3.23	---	2.57	1.76	1.22	2.96	3.53	---	3.23	2.83	2.79
MIN	2.65	2.85	---	1.75	1.22	.97	1.26	3.03	---	2.80	2.65	2.49

04036000 WEST BRANCH ONTONAGON RIVER NEAR BERGLAND, MI

LOCATION.--Lat 46°35'15", long 89°32'30", in SW1/4 NE1/4 sec.3, T.48 N., R.42 W., Ontonagon County, Hydrologic Unit 04020102, on right bank 0.4 mi downstream from dam at outlet of Lake Gogebic, and 1.5 mi east of Bergland.

DRAINAGE AREA.--162 mi^2.

PERIOD OF RECORD.--July 1942 to current year.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,290.81 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 5, 1942, nonrecording gage 0.4 mi upstream at different datum.

REMARKS.--Estimated daily discharges: Feb. 4, 5, 16-18, 23, and Mar. 1, 2, 19, 22. Records good except those below 5.0 ft^3/s, which are fair. Flow regulated by Lake Gogebic (station 04035995). Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--47 years, 174 ft^3/s, 14.59 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,400 ft^3/s, Apr. 26, 1960, gage height, 5.98 ft; minimum daily, 0.45 ft^3/s, Sept. 18, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 792 ft^3/s, Nov. 17, gage height, 4.53 ft; minimum daily, 0.76 ft^3/s, Sept. 26.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	108	177	488	216	250	145	157	331	69	391	2.2	20
2	103	184	474	209	264	140	167	47	102	383	2.6	19
3	107	183	393	207	261	138	173	39	110	357	2.7	18
4	101	177	334	201	248	138	190	33	111	332	2.8	18
5	108	180	274	236	241	138	210	29	110	281	3.0	16
6	147	249	232	261	234	139	226	25	105	178	3.1	20
7	175	403	224	256	226	133	238	24	107	163	3.2	22
8	168	494	222	263	222	130	252	22	360	162	3.1	24
9	167	505	220	261	217	131	258	24	638	154	2.8	22
10	152	483	218	251	211	130	263	26	636	70	2.4	17
11	142	496	212	241	210	129	269	27	617	20	2.6	11
12	141	483	211	239	206	127	271	27	608	18	2.6	3.8
13	134	487	211	230	200	127	274	78	597	17	2.5	1.5
14	92	463	210	220	195	126	281	109	585	16	2.7	1.3
15	89	449	209	216	189	131	289	109	573	16	2.7	1.1
16	91	639	207	216	182	128	312	109	544	16	2.8	.84
17	89	749	207	209	180	126	352	174	521	16	3.3	.82
18	88	736	205	209	172	124	392	242	493	16	2.8	.88
19	88	735	198	206	169	123	422	238	224	16	2.7	.89
20	90	718	144	204	162	122	444	242	89	16	2.9	.95
21	86	710	154	223	160	121	476	235	87	16	2.9	1.0
22	84	697	196	238	157	119	509	191	92	11	3.7	.96
23	88	678	196	231	157	118	549	106	285	6.6	3.4	.92
24	96	662	192	221	152	119	590	108	459	5.3	3.5	.89
25	104	638	190	243	151	118	617	392	527	4.9	5.0	.80
26	111	485	184	263	148	117	642	526	512	4.6	8.3	.76
27	113	384	188	256	148	121	652	240	501	4.6	12	.77
28	148	452	182	249	147	127	649	98	454	3.5	17	.82
29	189	487	211	240	---	134	641	81	312	2.8	20	.84
30	158	493	225	234	---	146	650	65	345	2.2	23	.87
31	159	---	218	226	---	153	---	67	---	2.1	24	---
TOTAL	3726	14676	7229	7175	5459	4018	11415	4064	10773	2701.6	178.3	227.71
MEAN	120	489	233	231	195	130	381	131	359	87.1	5.75	7.59
MAX	189	749	488	263	264	153	652	526	638	391	24	24
MIN	84	177	144	201	147	117	157	22	69	2.1	2.2	.76

CAL YR 1988 TOTAL 5380.63 MEAN 147 MAX 749 MIN .45 CFSM .91 IN 12.37
WTR YR 1989 TOTAL 7162.61 MEAN 196 MAX 749 MIN .76 CFSM 1.21 IN 16.45

04037400 CISCO LAKE NEAR WATERSMEET, MI

LOCATION.--Lat 46°15'10", long 89°27'07", in NE1/4 sec.32, T.45 N., R.41 W., Gogebic County, Hydrologic Unit 04020102, on left bank at outlet, 10 ft upstream from dam, 13 mi west of Watersmeet.

DRAINAGE AREA.--50.6 mi².

PERIOD OF RECORD.--July 1942 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,679.53 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Oct. 28, 1969, nonrecording gage at same site and datum.

REMARKS.--Record for Jan. 3-19, Feb. 1-11, Feb. 27 to Mar. 2, and Mar. 4-29 is from once daily gage readings furnished by Upper Peninsula Power Company. Record for Jan. 20, Mar. 3 and 30 is from gage inspection by USGS personnel. Cisco Lake (capacity 15,600 acre-ft) is the downstream lake in a chain of lakes used as storage reservoirs by Upper Peninsula Power Company for power production at Victoria Dam near Rockland. Lake level is controlled at the outlet by a concrete dam of two bays with removable flash boards. The major inlet to Cisco Lake is the combined outlet from Lindsley Lake and Thousand Island Lake. Streamflow records are currently collected at the outlet, Cisco Branch Ontonagon River (station 04037500). The lake level is maintained at an elevation of about 1,683.5 ft, above NGVD, during winter months and 1,684.0 ft, above NGVD, during summer months. Surface area of lake is 506 acres.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 4.69 ft, July 19, 1942; minimum, 1.72 ft, Mar. 20-22, 1948.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 4.20 ft, Aug. 31; minimum, 3.40 ft, Jan. 2.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.02	3.62	3.50	3.41	3.50	3.49	3.46	3.78	3.96	3.96	3.85	4.03
2	4.02	3.62	3.50	3.40	3.50	3.50	3.45	3.82	4.00	3.96	3.85	4.00
3	4.02	3.60	3.48	3.42	3.50	3.52	3.46	3.86	3.99	3.95	3.86	3.99
4	4.01	3.56	3.48	3.48	3.50	3.50	3.50	3.92	3.97	3.94	3.85	3.98
5	4.05	3.57	3.47	3.48	3.50	3.50	3.52	3.90	3.97	3.95	3.84	3.95
6	4.05	3.58	3.45	3.50	3.54	3.54	3.51	3.91	3.96	3.94	3.81	3.96
7	4.04	3.62	3.44	3.50	3.52	3.50	3.50	3.93	3.97	3.92	3.80	3.98
8	4.03	3.62	3.46	3.50	3.55	3.50	3.47	3.96	4.05	3.93	3.79	3.97
9	4.03	3.61	3.47	3.58	3.52	3.50	3.46	3.97	4.02	3.93	3.79	3.96
10	3.97	3.56	3.47	3.54	3.52	3.50	3.45	3.98	3.99	3.91	3.79	3.96
11	3.97	3.57	3.47	3.53	3.52	3.50	3.45	4.00	3.97	3.92	3.79	3.95
12	3.98	3.57	3.47	3.53	3.51	3.50	3.44	4.00	3.97	3.90	3.81	3.94
13	3.99	3.54	3.48	3.53	3.50	3.42	3.45	4.02	3.98	3.89	3.86	3.94
14	3.97	3.50	3.50	3.53	3.49	3.48	3.44	4.03	3.97	3.88	3.90	3.94
15	3.97	3.53	3.50	3.52	3.48	3.50	3.45	4.04	3.97	3.89	3.91	3.94
16	3.97	3.62	3.50	3.52	3.47	3.50	3.47	4.05	3.97	3.89	3.92	3.95
17	3.96	3.59	3.50	3.52	3.47	3.53	3.48	4.06	3.98	3.88	3.92	3.95
18	3.94	3.59	3.51	3.52	3.47	3.50	3.52	4.06	3.99	3.89	3.93	3.96
19	3.92	3.58	3.50	3.52	3.47	3.50	3.56	4.06	4.00	3.87	3.94	3.95
20	3.91	3.54	3.51	3.52	3.47	3.54	3.57	4.03	4.03	3.86	3.96	3.95
21	3.88	3.53	3.51	3.52	3.47	3.50	3.59	4.01	4.03	3.86	3.97	3.95
22	3.87	3.52	3.50	3.51	3.47	3.50	3.62	4.00	4.02	3.86	3.99	3.97
23	3.88	3.47	3.50	3.50	3.47	3.50	3.65	3.97	4.04	3.86	3.99	3.95
24	3.87	3.45	3.49	3.49	3.47	3.48	3.66	3.98	4.02	3.86	4.00	3.97
25	3.84	3.43	3.48	3.48	3.49	3.45	3.65	4.01	4.00	3.85	4.00	3.92
26	3.81	3.44	3.47	3.48	3.51	3.46	3.68	3.98	3.98	3.84	4.00	3.89
27	3.82	3.46	3.47	3.48	3.51	3.50	3.68	3.95	3.94	3.85	3.99	3.91
28	3.74	3.48	3.46	3.47	3.49	3.57	3.68	3.95	3.91	3.86	3.99	3.89
29	3.72	3.48	3.45	3.47	---	3.50	3.71	3.94	3.91	3.86	3.98	3.86
30	3.70	3.50	3.45	3.47	---	3.48	3.75	3.96	3.93	3.87	3.95	3.89
31	3.67	---	3.43	3.48	---	3.47	---	3.97	---	3.86	4.08	---
MEAN	3.92	3.55	3.48	3.50	3.50	3.50	3.54	3.97	3.98	3.89	3.91	3.95
MAX	4.05	3.62	3.51	3.58	3.55	3.57	3.75	4.06	4.05	3.96	4.08	4.03
MIN	3.67	3.43	3.43	3.40	3.47	3.42	3.44	3.78	3.91	3.84	3.79	3.86

CAL YR 1988	MEAN 3.59	MAX 4.16	MIN 3.03
WTR YR 1989	MEAN 3.73	MAX 4.08	MIN 3.40

04037500 CISCO BRANCH ONTONAGON RIVER AT CISCO LAKE OUTLET, MI

LOCATION.--Lat 46°15'12", long 89°27'05", in NE1/4 sec.32, T.45 N., R.41 W., Gogebic County, Hydrologic Unit 04020102, on left bank 80 ft downstream from Cisco Lake Dam, 2.5 mi upstream from Langford Creek, 5.0 mi upstream from U.S. Highway 2, and 13 mi west of Watersmeet.

DRAINAGE AREA.--50.7 mi².

PERIOD OF RECORD.--October 1944 to current year.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,672.69 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 1, 1968, nonrecording gage at same site and at datum 4.00 ft higher.

REMARKS.--No estimated daily discharges. Records good except those below 1.5 ft³/s, which are poor. Flow regulated by Cisco Lake (station 04037400). Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--45 years, 46.8 ft³/s, 12.54 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 288 ft³/s, May 1-4, 1951, gage height, 6.10 ft, present datum; minimum daily, 0.08 ft³/s, July 21, Aug. 2, 3, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 153 ft³/s, June 12, gage height, 5.44 ft; minimum daily, 0.21 ft³/s, May 13, 14.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.2	94	65	61	5.7	23	82	4.6	65	1.2	.31	132
2	1.2	94	64	61	4.9	23	82	4.2	54	.85	.31	97
3	12	92	64	33	6.0	23	62	3.8	54	.55	.28	75
4	28	89	63	6.5	6.4	24	36	2.3	51	.40	.27	74
5	30	90	63	6.9	5.6	24	55	1.2	52	.37	.27	32
6	30	92	62	7.5	13	39	73	1.1	50	.34	.28	.89
7	29	95	40	7.9	22	63	86	.85	44	.34	.30	.42
8	29	95	7.8	9.7	22	63	95	.83	82	.28	.31	.39
9	29	93	8.0	28	22	61	85	.69	138	.28	.31	.33
10	26	89	8.3	45	22	61	74	.51	135	.25	.31	.31
11	26	90	8.5	45	27	60	60	.29	128	.28	.33	.32
12	26	90	8.8	44	37	58	61	.22	123	.28	.30	.31
13	27	88	9.1	44	37	32	58	.21	103	.28	.31	.31
14	26	85	10	43	38	4.4	57	.21	63	.28	.31	.31
15	26	87	42	42	39	6.5	52	15	29	.28	.31	.31
16	26	117	70	42	39	6.9	44	25	23	.31	.31	.31
17	45	136	69	42	38	14	32	23	17	.31	.33	.30
18	72	136	69	42	36	23	22	32	17	.31	.31	.34
19	70	135	67	42	38	24	23	54	16	.28	.27	.34
20	70	131	69	42	29	41	33	86	17	.31	.28	.32
21	68	130	69	43	20	63	40	87	16	.31	.28	.33
22	66	128	68	42	20	62	26	82	21	.31	.29	.34
23	67	126	67	41	20	61	27	95	51	.34	.30	.35
24	90	124	66	40	21	60	54	81	77	.31	.31	.37
25	113	101	66	40	21	34	82	62	76	.28	.31	.35
26	110	83	65	40	22	1.9	94	70	75	.28	.31	.36
27	110	85	65	40	22	1.7	94	76	72	.28	.30	.35
28	103	78	64	40	22	35	74	63	70	.28	.30	.32
29	102	65	63	39	---	85	5.5	50	30	.31	.28	.35
30	100	65	62	26	---	85	5.1	62	1.3	.31	.28	.34
31	98	---	62	5.4	---	84	---	72	---	.31	63	---
TOTAL	1656.4	3003	1584.5	1090.9	655.6	1246.4	1673.6	1056.01	1750.3	11.10	71.97	418.97
MEAN	53.4	100	51.1	35.2	23.4	40.2	55.8	34.1	58.3	.36	2.32	14.0
MAX	113	136	70	61	39	85	95	95	138	1.2	63	132
MIN	1.2	65	7.8	5.4	4.9	1.7	5.1	.21	1.3	.25	.27	.30

CAL YR 1988 TOTAL 12664.09 MEAN 34.6 MAX 136 MIN .08 CFSM .68 IN 9.29
WTR YR 1989 TOTAL 14218.75 MEAN 39.0 MAX 138 MIN .21 CFSM .77 IN 10.43

04040000 ONTONAGON RIVER NEAR ROCKLAND, MI
(National stream quality accounting network station)

LOCATION.--Lat 46°43'15", long 89°12'25", in NE1/4 sec.20, T.50 N., R.39 W., Ontonagon County, Hydrologic Unit 04020102, on left bank 150 ft downstream from bridge on Victoria Road, 1.8 mi southwest of Rockland, and 2.4 mi downstream from confluence of Middle and West Branches.

DRAINAGE AREA.--1,340 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--June 1942 to current year.

REVISED RECORDS.--WSP 1387: 1943, 1946-47. WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 638.72 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 23, 1943, nonrecording gage and Nov. 23, 1943 to Oct. 17, 1967, water-stage recorder at site 50 ft upstream at same datum.

REMARKS.--Estimated daily discharges: Dec. 10 to Apr. 14. Water-discharge records good except for estimated daily discharges, which are fair. Flow regulated by Victoria powerplant on West Branch 5 mi upstream; Bond Falls Reservoir (station 04034000) 34 mi upstream; Lake Gogebic (station 04035995) and Cisco Lake (station 04037400), in headwaters.

AVERAGE DISCHARGE.--47 years, 1,416 ft³/s, 14.35 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 42,000 ft³/s, Aug. 22, 1942, gage height, 28.6 ft, from floodmark, from rating curve extended above 14,000 ft³/s on basis of slope-area measurement of peak flow; minimum daily, 102 ft³/s, July 28, 29, 1963.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 9,000 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Nov. 16	1300	*16,800	*16.45	No other peak greater than base discharge.			

Minimum daily discharge, 239 ft³/s, Sept. 27.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	644	1370	1830	1040	980	890	2500	3000	816	2520	425	498
2	532	1350	1590	1020	940	860	2200	2350	848	1350	419	617
3	577	1300	1520	990	900	840	3400	1670	821	1190	448	574
4	672	1350	1500	970	900	810	4900	1340	856	1060	440	574
5	1120	3800	1360	960	900	810	4800	1260	685	985	351	483
6	991	4040	1360	940	910	800	4300	1270	703	828	415	563
7	808	3040	1320	1030	920	800	3500	1260	832	743	378	478
8	863	2660	1220	990	910	630	3200	1220	3540	825	432	390
9	783	2810	841	970	900	750	2400	1060	8590	708	349	388
10	605	3020	760	960	890	840	2000	951	6750	677	394	572
11	688	3080	770	1000	900	830	1700	928	4380	581	398	393
12	613	2630	800	970	920	830	1600	633	2680	596	402	461
13	760	2290	880	1010	910	840	1600	529	4050	714	268	491
14	485	2370	1000	1020	930	840	2500	530	4450	708	418	525
15	584	2290	1100	1020	950	820	3690	624	3760	549	528	456
16	563	13000	1000	1020	910	800	5270	688	2730	698	369	510
17	691	9720	1040	1020	830	780	7400	685	2210	583	416	504
18	776	6380	1060	990	850	760	5580	744	1980	649	362	402
19	748	4550	1100	980	860	740	4820	800	1740	640	319	567
20	772	3280	1130	960	870	670	4530	902	1230	629	527	389
21	757	2660	1080	960	890	730	4190	1000	881	479	567	377
22	730	2250	1080	950	860	710	4540	1080	1170	443	329	305
23	860	1980	1120	990	870	710	4540	885	1510	542	498	356
24	2510	1840	1170	1020	930	700	4070	751	2750	503	416	296
25	4170	1970	1140	1020	960	610	3980	1580	2050	504	347	330
26	2390	2010	1100	960	980	800	3690	1890	1570	548	368	363
27	2010	2520	1090	1030	950	2500	3320	1490	1660	499	357	239
28	2830	2970	1080	1020	910	4000	2910	909	1510	517	413	302
29	2240	2430	1070	1000	---	4600	2570	755	1220	473	376	310
30	1730	2000	1040	990	---	4200	2360	708	1440	498	283	293
31	1300	---	1070	980	---	3300	---	750	---	494	608	---
TOTAL	35802	96960	35221	30780	25430	38800	108060	34242	69412	22733	12620	13006
MEAN	1155	3232	1136	993	908	1252	3602	1105	2314	733	407	434
MAX	4170	13000	1830	1040	980	4600	7400	3000	8590	2520	608	617
MIN	485	1300	760	940	830	610	1600	529	685	443	268	239

CAL YR 1988 TOTAL 458155 MEAN 1252 MAX 13000 MIN 232 CFSM .93 IN 12.72
WTR YR 1989 TOTAL 523066 MEAN 1433 MAX 13000 MIN 239 CFSM 1.07 IN 14.52

04040000 ONTONAGON RIVER NEAR ROCKLAND, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967, 1972 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: October 1974 to September 1981.
WATER TEMPERATURE: October 1974 to September 1981.

INSTRUMENTATION.--Water-quality monitor from Oct. 15, 1975 to Sept. 30, 1977.

REMARKS.--Quarterly samples were collected at or near Victoria Road bridge. Daily record for water years 1975, 1978-81 is from once-daily observer samples.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1975-80): Maximum recorded (more than 20 percent missing record), 192 microsiemens, Mar. 26, 1977, May 28, 1978; minimum recorded, 45 microsiemens, Dec. 2, 1975.
WATER TEMPERATURE (water years 1975-77, 1979-80): Maximum, 28.0°C, July 19, 1977; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND	SPE- CIFIC CON- DUCT- ANCE (US/CM)	PH (STAND- ARD UNITS)	TEMPER- ATURE WATER (DEG C)	TUR- BID- ITY (NTU)	OXYGEN, DIS- SOLVED (MG/L)	OXYGEN, DIS- SOLVED (PER- CENT SATUR- ATION)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP- TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
OCT 19...	1530	1030	136	7.70	8.0	15	11.8	101	K10	K33
JAN 17...	1545	1220	136	7.70	0.0	12	12.4	87	K6	K10
APR 19...	1600	4650	66	7.68	4.0	67	12.8	100	--	--
AUG 21...	1645	849	162	7.97	22.0	26	8.3	98	--	K34

DATE	HARD- NESS TOTAL (MG/L AS CACO3)	HARD- NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS- SOLVED (MG/L AS CA)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG)	SODIUM, DIS- SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD- SORP- TION RATIO	POTAS- SIUM, DIS- SOLVED (MG/L AS K)	BICAR- BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR- BONATE WATER DIS IT FIELD MG/L AS CO3
OCT 19...	70	11	19	5.4	3.1	9	0.2	1.2	72	0
JAN 17...	62	6	17	4.7	2.4	8	0.1	1.0	68	0
APR 19...	31	0	9.0	2.1	1.3	8	0.1	1.0	38	0
AUG 21...	79	7	22	5.8	2.9	7	0.1	1.1	88	0

DATE	ALKA- LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS- SOLVED (MG/L AS SO4)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL)	FLUO- RIDE, DIS- SOLVED (MG/L AS F)	SILICA, DIS- SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L)	SOLIDS, DIS- SOLVED (TONS PER AC-FT)	SOLIDS, DIS- SOLVED (TONS PER DAY)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N)
OCT 19...	59	9.8	3.0	<0.1	8.5	95	0.13	264	<0.01	<0.10
JAN 17...	56	10	2.1	<0.1	9.5	88	0.12	290	<0.01	<0.10
APR 19...	31	2.3	1.5	0.1	6.7	--	--	--	<0.01	0.10
AUG 21...	72	4.0	2.4	0.1	8.8	106	0.14	243	<0.01	<0.10

STREAMS TRIBUTARY TO LAKE SUPERIOR

04040000 ONTONAGON RIVER NEAR ROCKLAND, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
OCT 19...	0.02	0.03	0.50	0.03	<0.01	<0.01	30	<1	26	<0.5
JAN 17...	0.04	0.04	0.40	0.02	0.01	0.01	50	<1	25	<0.5
APR 19...	0.06	0.07	0.50	0.04	0.01	<0.01	240	<1	17	<0.5
AUG 21...	0.02	0.02	0.40	0.05	<0.01	<0.01	20	<1	30	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
OCT 19...	<1	<1	<3	3	110	<5	4	15	<0.1	<10
JAN 17...	<1	<1	<3	1	150	<5	<4	8	<0.1	<10
APR 19...	<1	1	<3	3	230	<5	<4	17	<0.1	<10
AUG 21...	<1	<1	<3	3	51	<1	<4	4	<0.1	10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
OCT 19...	1	<1	<1.0	42	<6	7	23	64	94
JAN 17...	<1	<1	1.0	37	<6	8	48	159	47
APR 19...	5	<1	<1.0	20	<6	9	115	1440	64
AUG 21...	<1	<1	<1.0	51	<6	<3	55	126	96

04040500 STURGEON RIVER NEAR SIDNAW, MI

LOCATION.--Lat 46°35'03", long 88°34'33", in NE1/4 SE1/4 sec.5, T.48 N., R.34 W., Baraga County, Hydrologic Unit 04020104, on right bank 30 ft downstream from highway bridge, 3.0 mi downstream from Rock River, 3.5 mi northwest of Covington, 6.5 mi upstream from Perch River, 8.5 mi northeast of Sidnaw, and at mile 71.

DRAINAGE AREA.--171 mi².

PERIOD OF RECORD.--October 1912 to September 1915, April 1943 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1507: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,214.40 ft above National Geodetic Vertical Datum of 1929. October 1912 to September 1915, nonrecording gage at site 200 ft upstream at different datum. Apr. 2, 1943 to Oct. 1, 1946, nonrecording gage at present site and datum.

REMARKS.--Estimated daily discharges: Dec. 2, and Dec. 4 to Apr. 5. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--49 years, 215 ft³/s, 17.07 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,630 ft³/s, Apr. 24, 1960, gage height, 11.63 ft; minimum, 2.7 ft³/s, Sept. 13, 1976; minimum gage height, 2.97 ft, July 29, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,530 ft³/s, Apr. 26, gage height, 7.67 ft; minimum, 9.1 ft³/s, July 24, 26, gage height, 3.13 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	131	327	352	103	85	50	410	852	184	84	20	38
2	116	302	355	100	83	50	390	733	168	74	19	37
3	104	285	316	97	81	49	440	646	147	66	16	33
4	147	300	285	94	79	49	560	587	129	61	18	29
5	316	787	255	93	77	50	580	580	114	54	27	28
6	367	866	215	91	74	50	549	587	104	48	21	26
7	328	824	185	91	73	50	537	552	100	42	18	24
8	263	770	160	90	72	51	552	482	795	38	16	23
9	215	677	147	90	72	51	452	417	1160	35	13	52
10	182	647	137	90	72	52	424	369	1190	31	13	60
11	168	583	125	90	72	53	382	334	953	27	15	53
12	160	513	120	91	72	54	354	306	728	25	24	48
13	147	465	120	92	72	55	328	281	751	23	17	40
14	133	428	125	93	71	55	370	261	820	20	16	35
15	122	404	130	94	70	56	404	245	740	18	21	32
16	120	1240	130	95	67	56	569	228	627	16	21	27
17	167	1320	130	95	64	56	800	209	497	15	19	24
18	191	1120	132	95	62	55	763	190	396	14	17	21
19	199	899	140	94	61	54	752	191	334	14	16	18
20	188	745	144	94	60	53	814	219	282	13	45	17
21	176	614	148	93	58	53	845	229	231	11	49	16
22	194	505	150	92	57	52	971	200	190	10	39	15
23	221	450	148	91	55	51	1090	175	161	9.6	36	15
24	361	403	143	91	54	57	1190	179	147	9.4	33	15
25	470	376	136	90	53	67	1350	284	135	9.9	29	13
26	456	365	130	90	52	100	1510	279	127	9.5	24	13
27	440	410	124	89	51	350	1470	238	134	22	22	12
28	513	444	117	87	50	585	1330	200	116	26	20	12
29	450	465	113	86	---	560	1150	165	102	27	18	11
30	396	429	110	86	---	510	975	152	91	24	17	11
31	350	---	107	86	---	460	---	172	---	21	25	---
TOTAL	7791	17963	5129	2853	1869	3894	22311	10542	11653	897.4	704	798
MEAN	251	599	165	92.0	66.8	126	744	340	388	28.9	22.7	26.6
MAX	513	1320	355	103	85	585	1510	852	1190	84	49	60
MIN	104	285	107	86	50	49	328	152	91	9.4	13	11
CFSM	1.47	3.50	.97	.54	.39	.74	4.35	1.99	2.27	.17	.13	.16
IN.	1.69	3.91	1.12	.62	.41	.85	4.85	2.29	2.54	.20	.15	.17

CAL YR 1988 TOTAL 76990.6 MEAN 210 MAX 2010 MIN 5.8 CFSM 1.23 IN 16.75
WTR YR 1989 TOTAL 86404.4 MEAN 237 MAX 1510 MIN 9.4 CFSM 1.39 IN 18.80

04041500 STURGEON RIVER NEAR ALSTON, MI

LOCATION.--Lat 46°43'35", long 88°39'43", in SE1/4 sec.15, T.50 N., R.35 W., Baraga County, Hydrologic Unit 04020104, on right bank in powerhouse of Upper Peninsula Power Co. at Prickett Dam, 4.0 mi upstream from Clear Creek, 5.0 mi southeast of Alston, and at mile 45.

DRAINAGE AREA.--346 mi^2.

PERIOD OF RECORD.--February 1932 to June 1941, October 1942 to current year. Monthly discharge only for some periods, published in WSP 1307.

GAGE.--Water-stage recorder. Datum of gage is 710.3 ft mean tide at New York City datum (levels by U.S. Army Corps of Engineers). Prior to Jan. 5, 1948, nonrecording gage and Jan. 5, 1948 to Sept. 30, 1963, water-stage recorder at same site at datum 40.00 ft lower.

REMARKS.--No estimated daily discharges. Records good. Flow regulated by powerplant at station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--55 years (water years 1933-40, 1943-89), 421 ft^3/s, 16.52 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,360 ft^3/s, Apr. 24, 1960, gage height, 13.09 ft, present datum; minimum daily, 1 ft^3/s, Aug. 14-19, 1960.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,100 ft^3/s, June 8, gage height, 8.17 ft; minimum daily, 14 ft^3/s, Aug. 13.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	316	611	763	208	228	338	637	1320	293	316	139	66
2	300	610	611	196	234	347	583	1010	316	116	140	168
3	271	606	546	233	228	342	980	1120	295	299	305	92
4	272	606	630	260	175	329	1130	1040	309	59	204	105
5	276	1110	389	263	176	330	1020	750	298	254	91	257
6	274	1630	395	229	178	255	897	832	308	228	50	143
7	326	1170	621	310	172	307	791	929	310	150	341	105
8	328	1380	388	299	154	294	701	778	1390	103	313	16
9	430	951	394	255	170	302	776	567	2650	187	84	197
10	427	1050	322	260	209	173	792	619	2040	258	15	185
11	426	1090	270	256	196	172	715	565	1470	140	15	186
12	376	866	223	259	183	175	611	616	1230	156	15	167
13	375	792	218	258	238	221	609	519	1360	16	14	310
14	322	673	267	255	190	223	613	318	1560	186	178	85
15	270	673	421	232	247	222	612	302	1410	16	69	117
16	218	1870	175	228	237	174	742	304	898	143	143	15
17	205	2520	218	219	239	169	1220	281	885	183	169	90
18	269	1640	270	225	187	171	1460	317	908	242	220	155
19	266	1670	250	231	187	170	1340	277	723	16	16	67
20	295	1170	426	232	189	176	1230	306	589	16	127	100
21	273	1050	506	223	195	180	1240	418	278	16	201	260
22	324	760	317	225	197	201	1510	619	316	15	67	66
23	416	620	382	230	195	204	1660	293	528	15	104	104
24	631	679	505	229	289	206	1550	320	323	184	269	104
25	669	766	268	223	293	217	1900	422	317	279	244	234
26	849	621	268	229	291	259	2040	621	316	294	16	211
27	629	809	266	231	274	531	2040	517	316	213	46	16
28	802	706	216	229	334	876	1930	316	316	167	204	99
29	909	619	260	231	---	1190	1630	315	314	176	192	124
30	600	720	259	230	---	1100	1440	333	241	16	63	77
31	543	---	204	234	---	877	---	316	---	193	228	---
TOTAL	12887	30038	11248	7422	6085	10731	34399	17260	22507	4652	4282	3921
MEAN	416	1001	363	239	217	346	1147	557	750	150	138	131
MAX	909	2520	763	310	334	1190	2040	1320	2650	316	341	310
MIN	205	606	175	196	154	169	583	277	241	15	14	15
CFSM	1.20	2.89	1.05	.69	.63	1.00	3.32	1.61	2.17	.43	.40	.38
IN.	1.39	3.23	1.21	.80	.65	1.15	3.70	1.86	2.42	.50	.46	.42

CAL YR 1988 TOTAL 147977 MEAN 404 MAX 2970 MIN 16 CFSM 1.17 IN 15.91
WTR YR 1989 TOTAL 165432 MEAN 453 MAX 2650 MIN 14 CFSM 1.31 IN 17.79

04043050 TRAP ROCK RIVER NEAR LAKE LINDEN, MI

LOCATION.--Lat 47°13'43", long 88°23'07", in SE1/4 SE1/4 sec.20, T.56 N., R.32 W., Houghton County, Hydrologic Unit 04020103, on right bank 20 ft upstream from bridge on county highway, 2.0 mi northeast of Lake Linden, and 3.0 mi upstream from mouth.

DRAINAGE AREA.--28.0 mi².

PERIOD OF RECORD.--October 1966 to current year.

GAGE.--Water-stage recorder. Datum of gage is 621.7 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Nov. 16, Dec. 7, 9-12, 24, 25, Jan. 25, 29, Feb. 2-11, 19-24, and Mar. 3-9, 15. Records good. Small diversions for sprinkler irrigation. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--23 years, 46.9 ft³/s, 22.75 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,590 ft³/s, May 10, 1979, gage height, 10.72 ft; minimum daily, 6.8 ft³/s, Oct. 3, 1976; minimum gage height, 3.75 ft, July 22, 1988.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 380 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Nov. 16	unknown	*1,160	*a10.11	June 13	1600	969	9.40
Apr. 25	0400	510	7.41				

a From floodmark.

Minimum discharge, 11.0 ft³/s, Sept. 19, gage height, 3.80 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	21	58	55	31	28	23	67	184	29	47	16	15
2	20	54	51	31	26	23	65	183	26	36	16	14
3	20	50	51	30	24	23	83	175	25	30	16	13
4	35	57	46	31	23	23	147	181	23	26	16	13
5	47	190	45	31	23	23	162	215	22	24	15	16
6	35	188	45	31	23	23	156	158	25	22	15	15
7	29	118	44	31	23	23	146	112	39	21	15	14
8	25	93	42	30	23	22	132	104	210	20	14	14
9	24	94	41	30	23	22	105	97	147	20	14	14
10	21	116	40	30	24	23	83	89	88	20	14	13
11	21	105	36	32	26	24	71	81	54	19	14	13
12	21	82	36	32	27	26	64	73	49	18	13	13
13	20	95	37	31	27	24	65	66	742	18	13	13
14	20	106	36	31	25	24	96	64	345	18	14	13
15	20	119	33	31	25	24	128	59	146	17	14	12
16	23	814	33	30	24	24	205	52	100	17	13	13
17	96	372	33	31	25	23	291	46	71	17	13	12
18	62	157	33	30	25	22	197	42	53	17	13	12
19	60	142	33	30	25	22	188	43	45	16	13	12
20	60	178	33	29	24	22	214	45	37	16	16	12
21	48	120	32	29	24	21	232	50	33	16	17	13
22	55	87	32	29	24	21	304	39	30	15	25	13
23	69	73	34	29	24	22	267	35	30	15	23	13
24	155	67	35	29	24	24	298	35	35	15	20	13
25	104	69	36	29	26	30	422	81	30	15	17	12
26	80	71	35	29	25	37	353	58	47	14	16	13
27	69	98	34	29	24	53	365	42	93	29	15	13
28	108	96	34	29	23	85	327	34	49	21	14	13
29	76	75	33	29	---	101	239	31	35	17	14	13
30	58	64	33	29	---	91	215	30	36	17	13	13
31	53	---	32	29	---	73	---	30	---	17	14	---
TOTAL	1555	4008	1173	932	687	1021	5687	2534	2694	630	475	395
MEAN	50.2	134	37.8	30.1	24.5	32.9	190	81.7	89.8	20.3	15.3	13.2
MAX	155	814	55	32	28	101	422	215	742	47	25	16
MIN	20	50	32	29	23	21	64	30	22	14	13	12
CFSM	1.79	4.79	1.35	1.08	.88	1.18	6.79	2.92	3.21	.73	.55	.47
IN.	2.07	5.32	1.56	1.24	.91	1.36	7.56	3.37	3.58	.84	.63	.52

CAL YR 1988 TOTAL 19364 MEAN 52.9 MAX 814 MIN 10 CFSM 1.89 IN 25.73
WTR YR 1989 TOTAL 21791 MEAN 59.7 MAX 814 MIN 12 CFSM 2.13 IN 28.95

04044609 SAND RIVER WILDLIFE FLOODING AT SAND RIVER, MI

LOCATION.--Lat 46°29'14", long 87°07'30", in SW1/4 NE1/4 sec.12, T.47 N., R.23 W., Marquette County, Hydrologic Unit 04020201, on right bank at dam at Sand River, 1.2 mi upstream from mouth.

DRAINAGE AREA.--28.6 mi². Area of Sand River Wildlife Flooding is 0.6 mi².

PERIOD OF RECORD.--October 1983 to current year (gage heights only).

GAGE.--Water-stage recorder. Datum of gage is 600.0 ft above National Geodetic Vertical Datum of 1929 (Michigan Department of Natural Resources bench mark).

REMARKS.--Pond level regulated by concrete dam with two 20-foot stop-log bays and a 20-foot radial gate. Gage-height telemeter at station.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 11.84 ft, Nov. 6, 1988; minimum, 5.06 ft, July 13-16, 1989.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 11.84 ft, Nov. 6; minimum, 5.06 ft, July 13-16.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	9.21	9.93	8.81	7.90	7.58	7.39	7.76	5.91	6.17	5.16	5.65	5.34
2	9.23	9.58	8.65	7.88	7.56	7.38	7.11	5.77	5.91	5.12	5.66	5.39
3	9.27	9.24	8.56	7.85	7.55	7.38	7.09	5.66	5.65	5.32	5.64	5.39
4	9.32	9.37	8.45	7.83	7.52	7.38	7.35	5.59	5.48	6.10	5.61	5.36
5	9.45	10.13	8.40	7.80	7.49	7.38	7.71	5.55	5.37	6.11	5.60	5.35
6	9.56	11.31	8.35	7.78	7.48	7.38	7.74	5.51	5.33	5.63	5.56	5.34
7	9.62	10.33	8.32	7.76	7.48	7.38	7.69	5.47	5.30	5.40	5.53	5.33
8	9.66	8.25	8.28	7.77	7.46	7.38	7.55	5.42	6.09	5.29	5.51	5.33
9	9.67	7.38	8.21	7.77	7.45	7.38	7.04	5.37	7.57	5.22	5.48	5.33
10	9.64	8.48	8.14	7.76	7.45	7.39	6.71	5.32	7.89	5.16	5.43	5.34
11	9.64	8.87	8.11	7.74	7.45	7.42	6.29	5.28	7.61	5.12	5.40	5.35
12	9.69	8.90	8.07	7.73	7.45	7.46	6.11	5.25	7.11	5.09	5.35	5.55
13	9.72	8.86	6.06	7.70	7.44	7.47	5.91	5.22	7.12	5.07	5.34	5.64
14	9.72	8.82	8.07	7.69	7.44	7.48	6.03	5.22	7.80	5.06	5.35	5.65
15	9.71	8.75	8.06	7.67	7.44	7.48	6.19	5.23	7.95	5.06	5.38	5.66
16	9.70	8.78	8.02	7.65	7.43	7.46	6.52	5.21	7.70	5.07	5.35	5.64
17	9.70	8.83	8.00	7.64	7.42	7.46	7.12	5.20	7.57	5.07	5.34	5.61
18	9.73	8.78	7.98	7.64	7.40	7.46	7.38	5.18	7.82	5.09	5.31	5.57
19	9.83	8.67	7.97	7.63	7.40	7.44	7.28	5.17	7.66	5.25	5.29	5.51
20	9.87	8.60	7.98	7.62	7.40	7.43	7.17	5.18	7.23	5.31	5.29	5.46
21	9.88	8.58	8.06	7.60	7.39	7.42	7.10	5.24	6.64	5.31	5.28	5.43
22	9.88	8.51	8.11	7.60	7.38	7.41	7.08	5.22	5.95	5.32	5.29	5.39
23	9.90	8.45	8.16	7.60	7.37	7.42	7.01	5.19	5.59	5.34	5.29	5.38
24	9.98	8.41	8.21	7.60	7.37	7.47	6.85	5.23	5.60	5.37	5.28	5.39
25	9.75	8.39	8.21	7.59	7.38	7.59	6.81	5.70	5.59	5.40	5.26	5.36
26	9.45	8.39	8.17	7.58	7.40	7.81	7.11	5.80	5.47	5.43	5.25	5.34
27	9.26	8.67	8.13	7.58	7.40	8.21	7.06	5.60	5.40	5.50	5.24	5.34
28	9.81	9.18	8.09	7.58	7.40	8.70	6.71	5.44	5.32	5.58	5.23	5.31
29	10.03	9.21	8.02	7.57	---	8.92	6.31	5.34	5.26	5.60	5.22	5.27
30	10.04	9.00	7.97	7.57	---	9.05	6.04	5.30	5.20	5.62	5.20	5.27
31	10.00	---	7.94	7.57	---	8.79	---	5.84	---	5.64	5.25	---
MEAN	9.67	8.96	8.18	7.69	7.44	7.65	6.93	5.41	6.41	5.35	5.38	5.42
MAX	10.04	11.31	8.81	7.90	7.58	9.05	7.76	5.91	7.95	6.11	5.66	5.66
MIN	9.21	7.38	7.94	7.57	7.37	7.38	5.91	5.17	5.20	5.06	5.20	5.27

CAL YR 1988 MEAN 7.93 MAX 11.31 MIN 5.74
WTR YR 1989 MEAN 7.04 MAX 11.31 MIN 5.06

04045500 TAHQUAMENON RIVER NEAR TAHQUAMENON PARADISE, MI
(National stream quality accounting network station)

LOCATION.--Lat 46°34'30", long 85°16'10", in NE1/4 sec.11, T.48 N., R.8 W., Luce County, Hydrologic Unit 04020202, on left bank 0.7 mi upstream from Tahquamenon (Big) Falls, 11.5 mi west of Tahquamenon Paradise, and 19 mi northeast of Newberry.

DRAINAGE AREA.--790 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--August 1953 to current year.

GAGE.--Water-stage recorder. Datum of gage is 698.03 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--No estimated daily discharges. Water-discharge records good.

AVERAGE DISCHARGE.--36 years, 929 ft³/s, 15.97 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,990 ft³/s, May 10, 1960, gage height, 10.26 ft; minimum, 157 ft³/s, July 26, 1955, July 8, 1988; minimum gage height, 2.75 ft, July 8, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,240 ft³/s, Apr.20, 21, 22, gage height, 7.67 ft; minimum, 178 ft³/s, July 17, 18, 24; minimum gage height, 2.89 ft, July 17, 18.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	753	1620	2290	938	592	421	1470	2480	916	325	205	303
2	808	1700	2270	905	611	419	1600	2350	1010	304	199	330
3	877	1740	2160	873	620	417	1770	2220	1090	285	219	336
4	981	1750	2040	847	616	424	1990	2090	1130	270	445	325
5	1080	1890	1940	806	600	416	2250	1930	1150	269	596	312
6	1170	2380	1820	763	577	411	2450	1820	1120	260	633	303
7	1210	2670	1690	726	558	415	2680	1690	1050	243	645	297
8	1220	2890	1550	713	545	413	2880	1580	987	242	626	301
9	1200	3000	1340	705	535	407	2960	1470	941	234	596	307
10	1160	3020	1230	704	518	407	3010	1360	910	217	538	328
11	1130	3010	1140	701	505	407	3000	1250	889	213	478	348
12	1130	2930	1060	696	494	416	2930	1140	819	209	440	345
13	1110	2870	972	686	487	427	2880	1050	756	199	390	335
14	1070	2790	891	673	483	433	2840	953	693	198	347	325
15	1010	2690	825	663	478	445	2860	857	711	191	320	312
16	974	2640	776	654	479	442	2920	780	759	189	310	300
17	927	2550	732	647	478	440	3010	727	799	184	305	290
18	920	2420	701	634	474	441	3140	663	826	185	299	285
19	944	2310	672	627	464	447	3190	599	811	189	289	280
20	951	2220	665	614	453	444	3220	564	786	189	277	272
21	951	2130	724	611	446	444	3230	640	736	190	277	272
22	958	2040	782	596	440	448	3220	723	687	188	281	264
23	966	1930	839	584	439	448	3180	740	632	184	279	270
24	1010	1820	898	581	433	451	3110	724	569	184	280	301
25	1110	1710	952	585	420	472	3040	820	533	190	277	293
26	1220	1610	981	591	415	532	2990	956	496	200	264	282
27	1290	1790	1000	582	415	644	2900	990	445	217	259	294
28	1410	2000	1010	576	416	866	2830	1020	403	230	259	286
29	1490	2150	1010	572	---	1080	2720	956	393	235	255	266
30	1540	2250	990	574	---	1250	2610	878	362	222	252	276
31	1570	---	966	577	---	1370	---	854	---	213	265	---
TOTAL	34140	68520	36916	21004	13991	16497	82880	36874	23409	6851	11105	9038
MEAN	1101	2284	1191	678	500	532	2763	1189	780	221	358	301
MAX	1570	3020	2290	938	620	1370	3230	2480	1150	325	645	348
MIN	753	1610	665	572	415	407	1470	564	362	184	199	264
CFSM	1.39	2.89	1.51	.86	.63	.67	3.50	1.51	.99	.28	.45	.38
IN.	1.61	3.23	1.74	.99	.66	.78	3.90	1.74	1.10	.32	.52	.43

CAL YR 1988 TOTAL 353608 MEAN 966 MAX 5580 MIN 165 CFSM 1.22 IN 16.65
WTR YR 1989 TOTAL 361225 MEAN 990 MAX 3230 MIN 184 CFSM 1.25 IN 17.01

04045500 TAHQUAMENON RIVER NEAR TAHQUAMENON PARADISE, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967, 1973 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: October 1974 to September 1981.
WATER TEMPERATURE: October 1974 to September 1981.

INSTRUMENTATION.--Water-quality monitor from Oct. 1, 1975 to Sept. 30, 1981.

REMARKS.--Quarterly cross-sectional samples were collected at cableway 40 ft downstream from gage or at wading section 600 ft downstream from gage.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1976-77, 1979-81): Maximum recorded (more than 20 percent missing record), 238 microsiemens, Jan. 24, 1977; minimum, 34 microsiemens, Apr. 17, 18, 1976.
WATER TEMPERATURE (water years 1976-77, 1979-81): Maximum, 26.5°C, May 21, 1977; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
OCT 04...	1550	938	142	7.50	10.0	3.2	8.6	78	K17	K40
JAN 30...	1530	569	150	7.49	0.0	3.3	9.1	65	K34	K23
APR 20...	1200	3310	59	7.34	5.0	1.5	10.5	84	<5	K10
JUL 18...	1345	281	191	8.09	22.0	2.2	7.5	88	K12	K8

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
OCT 04...	73	24	20	5.6	1.9	5	0.1	0.7	60	0
JAN 30...	69	16	19	5.3	1.9	6	0.1	0.7	64	0
APR 20...	32	11	8.7	2.4	1.0	6	0.1	0.6	26	0
JUL 18...	98	11	27	7.5	2.4	5	0.1	0.7	106	0

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
OCT 04...	49	23	2.4	<0.1	7.9	111	0.15	281	<0.01	<0.10
JAN 30...	53	18	1.9	0.1	9.0	100	0.14	154	<0.01	0.15
APR 20...	21	6.0	1.5	0.1	4.2	63	0.09	563	<0.01	<0.10
JUL 18...	87	12	2.2	0.1	6.0	120	0.16	91.0	<0.01	<0.10

04045500 TAHQUAMENON RIVER NEAR TAHQUAMENON PARADISE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
OCT										
04...	0.06	0.04	0.70	0.02	0.02	<0.01	70	<1	23	<0.5
JAN										
30...	0.05	0.05	0.40	<0.01	<0.01	<0.01	60	<1	19	<0.5
APR										
20...	0.03	0.04	0.50	<0.01	<0.01	<0.01	100	<1	12	<0.5
JUL										
18...	0.03	--	0.70	0.03	0.01	<0.01	20	1	26	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
OCT										
04...	<1	<1	<3	3	290	<5	<4	17	<0.1	<10
JAN										
30...	<1	<1	<3	1	390	<5	<4	30	0.3	<10
APR										
20...	<1	<1	<3	5	190	<5	<4	7	<0.1	<10
JUL										
18...	<1	2	<3	5	140	1	<4	4	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
OCT									
04...	<1	<1	<1.0	48	<6	8	4	10	76
JAN									
30...	2	<1	<1.0	44	<6	10	2	3.1	61
APR									
20...	3	<1	1.0	22	<6	12	6	54	42
JUL									
18...	1	<1	<1.0	65	<6	24	3	2.3	35

04045580 ST. MARYS RIVER ABOVE SAULT STE. MARIE, MI
(National stream quality accounting network and radiochemical station)

LOCATION.--Lat 46°29'29", long 84°25'17", in NW1/4 sec.10, T.47 N., R.1 W., Chippewa County, Hydrologic Unit 04020300, at Sault Ste. Marie municipal raw-water intake at Big Point, 2.6 mi west of the International Bridge, at Sault Ste. Marie.

DRAINAGE AREA.--80,900 mi², approximately.

PERIOD OF RECORD.--Water years 1970 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: March 1974 to September 1981.
WATER TEMPERATURE: March 1974 to September 1981.

REMARKS.--Quarterly samples were collected at the raw-water tap in Sault Ste. Marie municipal water plant at Big Point. Intake is 1,500 ft from water plant at a depth of 30 ft, 10 ft above bottom of channel. Prior to the 1983 water year, water temperatures were measured at the raw-water tap. Since 1983, water temperatures have been measured in the stream near the water plant, and therefore, are not comparable with those in "EXTREMES FOR PERIOD OF DAILY RECORD."

COOPERATION.--Discharges are monthly means provided by U.S. Army Corps of Engineers, Sault Ste. Marie.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1975-81): Maximum daily, 113 microsiemens, Oct. 26, 1980; minimum daily, 76 microsiemens, Apr. 24, 1975.
WATER TEMPERATURE (water years 1975-81): Maximum daily, 24.0°C, July 25, 1979; minimum daily, 0.0°C, Mar. 14, 15, 1974, Feb. 1, 1979.

EXTREMES OUTSIDE PERIOD OF DAILY RECORD.--A water temperature of 27.0°C was measured July 12, 1988.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, IN CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
OCT										
05...	1410	67500	95	7.90	9.0	1.0	11.5	101	<2	<2
JAN										
31...	1400	79400	100	7.59	0.0	1.7	14.4	103	<1	K1
APR										
19...	1715	78400	92	7.78	8.5	1.4	11.0	96	<1	K2
JUL										
19...	0845	94000	94	8.07	19.5	0.5	9.0	100	K4	K4

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
OCT										
05...	45	5	13	3.0	1.4	6	0.1	0.6	48	0
JAN										
31...	47	5	14	2.8	1.5	6	0.1	0.6	51	0
APR										
19...	44	4	13	2.9	1.3	6	0.1	0.6	49	0
JUL										
19...	44	3	13	2.8	1.4	6	0.1	0.5	51	0

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
OCT										
05...	40	4.4	1.3	<0.1	2.2	57	0.08	10400	<0.01	0.27
JAN										
31...	42	4.1	1.2	<0.1	2.5	51	0.07	10900	<0.01	0.34
APR										
19...	40	3.0	1.3	0.1	2.7	52	0.07	11000	<0.01	0.30
JUL										
19...	41	3.0	1.4	0.1	2.3	55	0.07	14000	<0.01	0.28

04045580 ST. MARYS RIVER ABOVE SAULT STE. MARIE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
OCT 05...	<0.01	<0.01	0.30	0.01	0.01	<0.01	<10	1	12	<0.5
JAN 31...	<0.01	<0.01	<0.20	<0.01	<0.01	<0.01	<10	<1	12	<0.5
APR 19...	0.01	<0.01	0.30	<0.01	<0.01	<0.01	20	<1	12	<0.5
JUL 19...	0.02	--	<0.20	0.01	0.02	<0.01	<10	1	12	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
OCT 05...	<1	<1	<3	5	3	<5	<4	1	<0.1	<10
JAN 31...	<1	<1	<3	5	17	<5	<4	1	<0.1	<10
APR 19...	<1	<1	<3	4	23	<5	<4	2	<0.1	<10
JUL 19...	<1	<1	<3	4	4	1	<4	2	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	GROSS ALPHA, DISSOLVED (UG/L AS U-NAT)	GROSS ALPHA, SUSP. TOTAL (UG/L AS U-NAT)	GROSS BETA, DISSOLVED (PCI/L AS CS-137)	GROSS BETA, SUSP. TOTAL (PCI/L AS CS-137)
OCT 05...	<1	<1	<1.0	22	<6	76	0.8	<0.4	1.2	<0.4
JAN 31...	1	<1	<1.0	23	<6	86	--	--	--	--
APR 19...	2	<1	<1.0	23	<6	63	<0.4	<0.4	0.9	<0.4
JUL 19...	2	<1	<1.0	22	<6	76	--	--	--	--

DATE	GROSS BETA, DISSOLVED (PCI/L AS SR/YT-90)	GROSS BETA, SUSP. TOTAL (PCI/L AS SR/YT-90)	RADIUM 226, DISSOLVED, RADON METHOD (PCI/L)	URANIUM NATURAL DISSOLVED (UG/L AS U)
OCT 05...	1.1	<0.4	0.05	0.04
JAN 31...	--	--	--	--
APR 19...	0.8	<0.4	0.02	0.03
JUL 19...	--	--	--	--

04047200 MANISTIQUE LAKE NEAR CURTIS, MI

LOCATION.--Lat 46°14'47", long 85°51'06", in SW1/4 SE1/4 sec.31, T.45 N., R.12 W., Luce County, Hydrologic Unit 04060106, at lake outlet, 5.8 mi northwest of Curtis.

DRAINAGE AREA.--118 mi², approximately.

PERIOD OF RECORD.--April 1942 to current year.

GAGE.--Water-stage recorder. Datum of gage is 683.08 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Apr. 15, 1943 and Oct. 1, 1968 to Oct. 4, 1976, nonrecording gage at same datum.

REMARKS.--Lake level controlled by concrete dam with removable flash boards constructed in 1978 on the outlet, and by a dam on Portage Creek, one of the inlets. From 1948 to 1978 lake level controlled by timber dam with removable flash boards on outlet. Occasionally during periods of high flow, backwater from Fox River raises the lake level. Major inlets to Manistique Lake are Helmer Creek from North Manistique Lake, Portage Creek from South Manistique Lake, and Fork Lake Outlet. The outlet is Manistique River. Streamflow records were collected for South Manistique Lake Outlet (station 04046500) from May 1942 to September 1944, for North Manistique Lake Outlet (station 04047000) from August 1942 to September 1944, and for Manistique River (station 04047500) from Apr. 1942 to June 1950. Established legal level; 686.00 ft above NGVD, established by Circuit Court, January 1948. Surface area of lake is 10,100 acres.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 6.28 ft, May 14, 15 or 16, 1960, from floodmark; minimum, 1.33 ft, Aug. 10, 1948, result of dam construction.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 4.00 ft, Dec. 1, 2; minimum daily, 2.86 ft, Sept. 29.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.27	3.32	3.99	3.83	3.42	3.05	2.94	3.53	3.47	3.54	3.31	3.40
2	3.28	3.32	3.99	3.83	3.40	3.04	2.96	3.53	3.53	3.53	3.29	3.37
3	3.28	3.33	3.94	3.82	3.39	3.03	2.97	3.51	3.56	3.51	3.35	3.37
4	3.31	3.33	3.97	3.80	3.38	3.03	3.02	3.50	3.54	3.50	3.53	3.36
5	3.32	3.44	3.97	3.79	3.36	3.03	3.05	3.49	3.58	3.48	3.56	3.32
6	3.30	3.60	3.96	3.77	3.34	3.02	3.08	3.48	3.58	3.46	3.58	3.31
7	3.29	3.62	3.93	3.75	3.32	3.02	3.11	3.44	3.60	3.43	3.58	3.30
8	3.30	3.66	3.94	3.75	3.31	3.02	3.14	3.45	3.61	3.42	3.59	3.28
9	3.27	3.70	3.94	3.75	3.30	2.99	3.17	3.42	3.61	3.40	3.61	3.29
10	3.18	3.68	3.92	3.74	3.28	2.96	3.19	3.40	3.61	3.35	3.62	3.28
11	3.22	3.72	3.92	3.71	3.27	2.96	3.20	3.37	3.64	3.36	3.62	3.27
12	3.25	3.78	3.92	3.70	3.27	2.94	3.21	3.33	3.67	3.33	3.62	3.21
13	3.24	3.77	3.92	3.70	3.26	2.94	3.22	3.31	3.67	3.31	3.62	3.22
14	3.24	3.77	3.92	3.68	3.25	2.94	3.25	3.29	3.66	3.27	3.62	3.20
15	3.24	3.87	3.92	3.65	3.23	2.97	3.27	3.29	3.67	3.26	3.62	3.18
16	3.22	3.79	3.92	3.63	3.21	2.97	3.30	3.31	3.67	3.25	3.64	3.16
17	3.22	3.73	3.90	3.63	3.19	2.95	3.33	3.31	3.68	3.24	3.64	3.15
18	3.21	3.81	3.88	3.62	3.18	2.94	3.37	3.30	3.70	3.23	3.63	3.14
19	3.22	3.86	3.87	3.62	3.16	2.93	3.38	3.31	3.71	3.23	3.61	3.11
20	3.21	3.81	3.88	3.60	3.15	2.92	3.41	3.30	3.72	3.21	3.61	3.10
21	3.22	3.82	3.89	3.59	3.13	2.91	3.43	3.32	3.73	3.20	3.61	3.09
22	3.21	3.82	3.87	3.57	3.11	2.90	3.44	3.36	3.72	3.19	3.61	3.01
23	3.24	3.82	3.92	3.55	3.10	2.89	3.46	3.34	3.72	3.18	3.58	2.94
24	3.24	3.82	3.91	3.53	3.08	2.87	3.47	3.36	3.68	3.16	3.55	2.99
25	3.23	3.80	3.90	3.52	3.07	2.87	3.49	3.40	3.68	3.15	3.52	2.95
26	3.24	3.82	3.89	3.52	3.07	2.87	3.51	3.40	3.66	3.21	3.49	2.92
27	3.28	3.88	3.90	3.50	3.06	2.88	3.53	3.39	3.63	3.36	3.46	2.92
28	3.19	3.92	3.89	3.48	3.05	2.90	3.54	3.41	3.60	3.37	3.45	2.88
29	3.26	3.96	3.88	3.46	---	2.91	3.56	3.41	3.58	3.35	3.41	2.86
30	3.29	3.98	3.86	3.45	---	2.92	3.53	3.43	3.56	3.34	3.37	2.87
31	3.29	---	3.84	3.44	---	2.93	---	3.45	---	3.32	3.40	---
MEAN	3.25	3.72	3.91	3.64	3.23	2.95	3.28	3.39	3.63	3.33	3.54	3.15
MAX	3.32	3.98	3.99	3.83	3.42	3.05	3.56	3.53	3.73	3.54	3.64	3.40
MIN	3.18	3.32	3.84	3.44	3.05	2.87	2.94	3.29	3.47	3.15	3.29	2.86

CAL YR 1988 MEAN 3.20 MAX 3.99 MIN 2.60
WTR YR 1989 MEAN 3.42 MAX 3.99 MIN 2.86

04056500 MANISTIQUE RIVER NEAR MANISTIQUE, MI

LOCATION.--Lat 46°01'50", long 86°09'40", in SE1/4 sec.15, T.42 N., R.15 W., Schoolcraft County, Hydrologic Unit 04060106, on left bank 1.0 mi downstream from West Branch, 6.0 mi northeast of Manistique, and at mile 19.5.

DRAINAGE AREA.--1,100 mi², approximately.

PERIOD OF RECORD.--March 1938 to current year.

REVISED RECORDS.--WSP 1387: 1940-42(M), 1943, 1945. WSP 1627, 1727: 1938, 1939.

GAGE.--Water-stage recorder. Elevation of gage is 608 ft, from river-profile map. Prior to July 15, 1939, non-recording gage at site 1,600 ft upstream at different datum.

REMARKS.--Estimated daily discharges: Dec. 2 to Apr. 4. Records good except for estimated daily discharges, which are fair. Since July 1948, slight regulation by dam on outlet of Manistique Lake (station 04047200). Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--51 years, 1,438 ft³/s, 17.75 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 16,900 ft³/s, May 11, 1960, gage height, 12.85 ft; minimum, 288 ft³/s, Oct. 4, 1948; minimum gage height, 1.01 ft, Aug. 23, 1941.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 6,010 ft³/s, Nov. 10, gage height, 10.37 ft; maximum gage height, 10.38 ft, Apr. 4, backwater from ice; minimum discharge, 542 ft³/s, Sept. 30, gage height, 2.88 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1060	2580	4140	1800	1250	840	3100	3210	1650	958	650	702
2	1120	2590	4050	1750	1250	840	3500	3060	1770	918	650	777
3	1230	2540	3700	1700	1200	840	4400	2900	1990	887	657	802
4	1300	2480	3400	1650	1150	840	4600	2730	2040	860	751	789
5	1370	2560	3000	1650	1120	840	4750	2620	1900	837	951	763
6	1400	3120	2700	1600	1100	820	4870	2550	1740	819	990	714
7	1420	3790	2500	1550	1100	820	5280	2510	1590	797	961	675
8	1410	4490	2300	1550	1100	820	5550	2440	1480	770	894	680
9	1350	5420	2150	1520	1100	820	5530	2350	1510	751	830	703
10	1280	5940	2000	1500	1100	820	5460	2240	1680	736	773	691
11	1250	5740	1900	1490	1100	820	5420	2090	1840	725	725	695
12	1290	5390	1800	1480	1100	840	4760	1950	1900	713	704	696
13	1370	5080	1750	1480	1100	860	4430	1820	1890	697	692	683
14	1400	4770	1650	1480	1100	860	4200	1730	1840	680	698	662
15	1360	4550	1600	1480	1100	860	3990	1700	1880	666	703	648
16	1290	4360	1550	1420	1080	880	3890	1640	2000	658	709	642
17	1270	4180	1500	1400	1060	860	3950	1490	2090	653	712	628
18	1300	4040	1450	1400	1040	860	4050	1380	2190	653	690	615
19	1370	3880	1400	1380	1000	860	4160	1300	2200	651	668	603
20	1400	3720	1400	1350	960	860	4190	1260	2090	650	653	584
21	1430	3560	1450	1300	940	840	4110	1330	1930	650	658	574
22	1510	3380	1550	1280	940	840	4000	1480	1730	650	663	570
23	1590	3190	1600	1280	940	840	3890	1580	1570	650	690	578
24	1700	3000	1700	1280	920	840	3770	1580	1460	650	737	575
25	1870	2820	1750	1260	900	880	3670	1640	1360	650	723	580
26	2010	2680	1850	1250	880	980	3580	1880	1270	650	702	586
27	2110	2780	1950	1250	860	1200	3510	2000	1180	671	690	569
28	2240	3170	2000	1250	860	1600	3460	1960	1100	769	681	563
29	2410	3570	2000	1250	---	2000	3430	1830	1040	710	674	559
30	2520	3940	1950	1250	---	2400	3330	1660	992	669	666	547
31	2560	---	1850	1250	---	2700	---	1590	---	653	662	---
TOTAL	48190	113310	65590	44530	29350	31980	126830	61500	50902	22451	22607	19453
MEAN	1555	3777	2116	1436	1048	1032	4228	1984	1697	724	729	648
MAX	2560	5940	4140	1800	1250	2700	5550	3210	2200	958	990	802
MIN	1060	2480	1400	1250	860	820	3100	1260	992	650	650	547
CFSM	1.41	3.43	1.92	1.31	.95	.94	3.84	1.80	1.54	.66	.66	.59
IN.	1.63	3.83	2.22	1.51	.99	1.08	4.29	2.08	1.72	.76	.76	.66

CAL YR 1988 TOTAL 573036 MEAN 1566 MAX 9560 MIN 385 CFSM 1.42 IN 19.38
WTR YR 1989 TOTAL 636693 MEAN 1744 MAX 5940 MIN 547 CFSM 1.59 IN 21.53

04057000 INDIAN LAKE NEAR MANISTIQUE, MI

LOCATION.--Lat 45°59'30", long 86°17'15", in SW1/4 NE1/4 sec.34, T.42 N., R.16 W., Schoolcraft County, Hydrologic Unit 04060106, on east shore, just upstream from highway bridge over outlet of Indian Lake, 2.0 mi northwest of Manistique.

DRAINAGE AREA.--302 mi².

PERIOD OF RECORD.--March 1938 to current year.

GAGE.--Water-stage recorder. Datum of gage is 608.66 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to July 9, 1942, nonrecording gage at site 0.5 mi northwest at same datum.

REMARKS.--Indian lake is regulated by two vertical lift gates in concrete and earth-fill dam 1.5 mi downstream from lake on outlet. Major inlets to Indian Lake are Silver Creek, Dufour Creek, Indian River, Dead Creek, Smith Creek and Big Spring. Streamflow records for Indian River (station 04057000), at lake outlet, were collected from March 1938 to September 1971; annual peak discharge 1972-82. Established legal level; 613.27 ft, above NGVD. Surface area of lake is 8,660 acres.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily gage height, 7.79 ft, June 24, 1943; minimum daily, 3.01 ft, Feb. 20, 1948.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 4.98 ft, June 23; minimum, 3.34 ft, Mar. 12, 13.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.54	4.11	4.72	4.09	3.68	3.39	3.73	4.50	4.72	4.57	4.43	4.27
2	4.56	4.09	4.64	4.09	3.67	3.38	3.78	4.47	4.71	4.57	4.42	4.25
3	4.56	4.07	4.69	4.08	3.65	3.38	3.84	4.43	4.68	4.56	4.45	4.23
4	4.56	4.07	4.71	4.06	3.62	3.42	3.93	4.40	4.66	4.56	4.51	4.21
5	4.56	4.18	4.71	4.04	3.59	3.41	4.04	4.39	4.60	4.54	4.58	4.21
6	4.56	4.32	4.71	4.01	3.57	3.40	4.15	4.36	4.59	4.52	4.58	4.18
7	4.55	4.40	4.69	4.00	3.54	3.39	4.27	4.33	4.55	4.50	4.57	4.17
8	4.54	4.47	4.65	4.02	3.55	3.37	4.39	4.29	4.51	4.46	4.58	4.16
9	4.55	4.53	4.59	3.99	3.52	3.37	4.48	4.25	4.53	4.43	4.56	4.16
10	4.57	4.60	4.52	3.97	3.51	3.36	4.52	4.20	4.50	4.44	4.56	4.16
11	4.58	4.62	4.44	3.94	3.50	3.36	4.54	4.16	4.46	4.45	4.56	4.13
12	4.56	4.61	4.37	3.94	3.49	3.36	4.56	4.12	4.45	4.46	4.56	4.13
13	4.49	4.69	4.32	3.91	3.48	3.36	4.54	4.13	4.50	4.46	4.56	4.08
14	4.42	4.69	4.29	3.88	3.48	3.37	4.56	4.22	4.53	4.47	4.58	4.06
15	4.36	4.64	4.27	3.87	3.47	3.44	4.57	4.28	4.62	4.48	4.61	4.04
16	4.33	4.77	4.24	3.85	3.46	3.43	4.58	4.34	4.68	4.49	4.59	4.02
17	4.30	4.82	4.20	3.85	3.45	3.42	4.62	4.39	4.77	4.51	4.55	4.04
18	4.28	4.71	4.17	3.84	3.43	3.42	4.63	4.44	4.82	4.53	4.53	4.05
19	4.24	4.69	4.15	3.83	3.42	3.40	4.64	4.50	4.89	4.55	4.50	4.08
20	4.21	4.71	4.15	3.82	3.40	3.41	4.65	4.60	4.93	4.55	4.49	4.09
21	4.21	4.69	4.15	3.79	3.40	3.40	4.65	4.64	4.94	4.56	4.49	4.11
22	4.18	4.66	4.14	3.77	3.39	3.39	4.64	4.65	4.95	4.58	4.46	4.16
23	4.15	4.62	4.22	3.76	3.38	3.38	4.63	4.67	4.94	4.59	4.45	4.18
24	4.19	4.58	4.22	3.74	3.36	3.38	4.61	4.70	4.91	4.60	4.42	4.16
25	4.19	4.50	4.22	3.73	3.37	3.39	4.61	4.82	4.87	4.61	4.39	4.17
26	4.19	4.55	4.20	3.74	3.38	3.40	4.62	4.89	4.83	4.63	4.36	4.17
27	4.14	4.65	4.21	3.72	3.38	3.43	4.60	4.86	4.80	4.65	4.36	4.20
28	4.27	4.66	4.20	3.71	3.38	3.51	4.57	4.80	4.73	4.56	4.33	4.22
29	4.18	4.67	4.17	3.70	---	3.56	4.54	4.75	4.67	4.52	4.32	4.22
30	4.13	4.72	4.15	3.68	---	3.63	4.54	4.74	4.61	4.49	4.30	4.23
31	4.11	---	4.12	3.68	---	3.70	---	4.75	---	4.46	4.27	---
MEAN	4.36	4.54	4.36	3.87	3.48	3.42	4.43	4.49	4.70	4.53	4.48	4.15
MAX	4.58	4.82	4.72	4.09	3.68	3.70	4.65	4.89	4.95	4.65	4.61	4.27
MIN	4.11	4.07	4.12	3.68	3.36	3.36	3.73	4.12	4.45	4.43	4.27	4.02

CAL YR 1988 MEAN 4.05 MAX 4.90 MIN 3.13
WTR YR 1989 MEAN 4.24 MAX 4.95 MIN 3.36

04057510 STURGEON RIVER NEAR NAHMA JUNCTION, MI

LOCATION.--Lat 45°56'35", long 86°42'20", in SW1/4 SE1/4 sec.17, T.41 N., R.19 W., Delta County, Hydrologic Unit 04030112, Hiawatha National Forest, on left bank 30 ft upstream from bridge on Forest Service Road 2231, 500 ft downstream from Mormon Creek, 0.1 mi east of Federal Forest Highway 13, and 3.2 mi north of Nahma Junction.

DRAINAGE AREA.--183 mi².

PERIOD OF RECORD.--October 1966 to current year.

GAGE.--Water-stage recorder. Datum of gage is 610.99 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 3 to Apr. 5. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--23 years, 203 ft³/s, 15.06 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,120 ft³/s, Apr. 21, 1985, gage height, 11.50 ft; minimum, 32 ft³/s, July 8, 1988, gage height, 3.55 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 930 ft³/s, Nov. 7, gage height, 7.62 ft; maximum gage height, 7.78 ft, Dec. 21, backwater from ice; minimum discharge, 47 ft³/s, Sept. 29, 30, gage height, 3.70 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	114	246	547	170	120	78	430	334	244	127	61	67
2	140	241	494	165	115	78	450	307	276	118	60	85
3	135	221	440	160	110	78	500	283	283	153	58	80
4	140	218	400	155	105	76	590	260	234	577	64	73
5	221	368	340	155	100	76	620	282	193	386	62	69
6	261	756	290	150	100	76	611	320	174	262	64	66
7	233	902	270	145	100	76	641	293	157	205	60	62
8	208	778	250	145	100	76	663	270	154	171	58	61
9	185	693	235	145	100	76	577	246	274	147	57	61
10	168	634	220	140	100	78	561	221	351	134	55	64
11	173	581	205	140	98	78	498	199	314	125	66	62
12	193	522	195	140	98	80	459	182	278	117	76	60
13	197	558	195	140	96	82	422	172	279	108	77	58
14	203	551	200	135	100	82	448	167	301	100	76	56
15	196	495	210	135	100	85	504	163	394	94	77	54
16	184	582	210	130	100	84	551	156	402	90	73	53
17	196	617	210	130	98	84	601	147	438	90	67	52
18	219	536	210	130	96	82	588	138	457	86	63	51
19	221	480	220	130	94	80	563	131	384	84	60	50
20	201	460	230	125	92	80	540	140	318	80	59	50
21	200	434	245	125	90	80	524	191	262	76	61	49
22	215	401	250	120	88	80	507	173	223	73	60	49
23	212	368	245	120	88	80	480	149	315	69	60	50
24	299	345	240	120	86	80	451	144	307	68	58	51
25	331	326	230	120	84	85	435	295	242	66	54	50
26	306	336	220	120	82	130	471	332	202	64	54	49
27	280	496	210	120	82	220	461	261	186	65	54	49
28	343	697	200	120	80	400	425	212	172	62	53	48
29	332	660	190	120	---	490	392	178	151	61	53	48
30	291	604	185	120	---	460	363	182	137	64	51	48
31	257	---	175	120	---	440	---	223	---	63	53	---
TOTAL	6854	15106	7961	4190	2704	4130	15326	6751	8102	3985	1904	1725
MEAN	221	504	257	135	96.6	133	511	218	270	129	61.4	57.5
MAX	343	902	547	170	120	490	663	334	457	577	77	85
MIN	114	218	175	120	80	76	363	131	137	61	51	48
CFSM	1.21	2.75	1.40	.74	.53	.73	2.79	1.19	1.48	.71	.34	.31
IN.	1.39	3.07	1.62	.85	.55	.84	3.12	1.37	1.65	.81	.39	.35

CAL YR 1988 TOTAL 65439 MEAN 179 MAX 1160 MIN 33 CFSM .98 IN 13.30
WTR YR 1989 TOTAL 78738 MEAN 216 MAX 902 MIN 48 CFSM 1.18 IN 16.01

04057800 MIDDLE BRANCH ESCANABA RIVER AT HUMBOLDT, MI

LOCATION.--Lat 46°29'57", long 87°53'11", in SW1/4 sec.1, T.47 N., R.29 W., Marquette County, Hydrologic Unit 04030110, on left bank 15 ft upstream from county highway, 1.5 mi downstream from Halfway Creek, and 0.3 mi north of Humboldt.

DRAINAGE AREA.--46.0 mi^2.

PERIOD OF RECORD.--June 1959 to current year.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Water-stage recorder. V-notch sharp-crested weir since Oct. 3, 1960. Datum of gage is 1,521.20 ft above National Geodetic Vertical Datum of 1929 (Cleveland-Cliffs Iron Co. bench mark). Prior to Sept. 1, 1960, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 1, 2, 4, 8-18, Dec. 20 to Jan. 22, Feb. 2-11, 14-21, Feb. 23 to Mar. 8, and Mar. 15-19. Records good except for estimated daily discharges, which are fair. From July 1960 to June 1972, some diversion 100 ft upstream by industry for iron ore processing; figures of runoff adjusted. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--30 years, 61.9 ft^3/s, 18.27 in/yr, adjusted for diversion 1960 to 1972.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,930 ft^3/s, Apr. 20, 1985, gage height, 9.21 ft; minimum, 4.0 ft^3/s, Sept. 12, 1976; minimum gage height, 1.07 ft, Aug. 24, 1960.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 692 ft^3/s, June 9, gage height, 6.14 ft; minimum, 6.8 ft^3/s, Aug. 9, gage height, 1.67 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	40	109	130	40	30	22	103	189	62	45	10	16
2	35	104	115	39	29	21	91	164	55	40	11	12
3	32	95	100	38	28	24	104	143	49	38	9.4	9.5
4	46	97	92	37	26	23	119	127	45	33	8.7	8.8
5	105	199	83	37	26	23	145	125	41	30	8.7	9.4
6	129	394	77	37	26	23	144	124	42	28	8.4	8.5
7	109	410	73	37	26	22	152	113	41	27	8.1	8.9
8	85	295	70	37	26	24	152	104	187	24	8.3	50
9	69	221	66	36	26	24	131	93	556	22	8.0	36
10	59	197	62	36	27	23	117	82	516	21	8.5	26
11	59	186	58	36	28	25	98	76	306	20	8.6	15
12	54	161	55	36	29	24	89	71	197	18	10	23
13	49	142	54	36	29	22	82	64	206	17	13	20
14	45	130	54	36	29	24	88	61	322	16	17	17
15	43	118	55	35	28	23	88	58	362	15	17	14
16	50	225	56	35	27	22	109	55	260	14	14	12
17	98	495	56	35	26	22	155	51	180	13	10	11
18	110	408	57	36	25	22	176	47	131	13	8.7	10
19	100	271	59	36	24	22	182	50	107	14	8.3	9.5
20	93	213	62	36	25	22	184	51	90	13	13	9.1
21	82	181	60	36	24	22	188	51	75	12	16	9.0
22	86	148	58	35	24	21	203	44	67	11	14	8.3
23	91	124	56	35	23	21	224	43	75	9.2	14	9.3
24	139	113	54	34	23	24	235	57	136	9.0	12	9.3
25	182	109	51	34	23	29	257	126	105	8.7	9.9	8.8
26	175	106	49	34	22	36	312	136	88	8.9	8.9	8.5
27	152	142	47	33	22	61	331	101	93	14	8.8	8.1
28	188	187	45	32	22	100	291	74	75	13	8.8	8.1
29	194	192	43	32	---	110	245	61	60	11	8.5	8.1
30	152	153	42	31	---	112	209	58	51	12	8.3	8.5
31	121	---	41	31	---	105	---	66	---	11	12	---
TOTAL	2972	5925	1980	1098	723	1098	5004	2665	4580	580.8	329.9	415.7
MEAN	95.9	198	63.9	35.4	25.8	35.4	167	86.0	153	18.7	10.6	13.9
MAX	194	495	130	40	30	112	331	189	556	45	17	50
MIN	32	95	41	31	22	21	82	43	41	8.7	8.0	8.1
CFSM	2.09	4.30	1.39	.77	.56	.77	3.63	1.87	3.33	.41	.23	.30
IN.	2.40	4.79	1.60	.89	.58	.89	4.05	2.16	3.70	.47	.27	.34

CAL YR 1988	TOTAL 25337.4	MEAN 69.2	MAX 656	MIN 5.3	CFSM 1.50	IN 20.49
WTR YR 1989	TOTAL 27371.4	MEAN 75.0	MAX 556	MIN 8.0	CFSM 1.63	IN 22.13

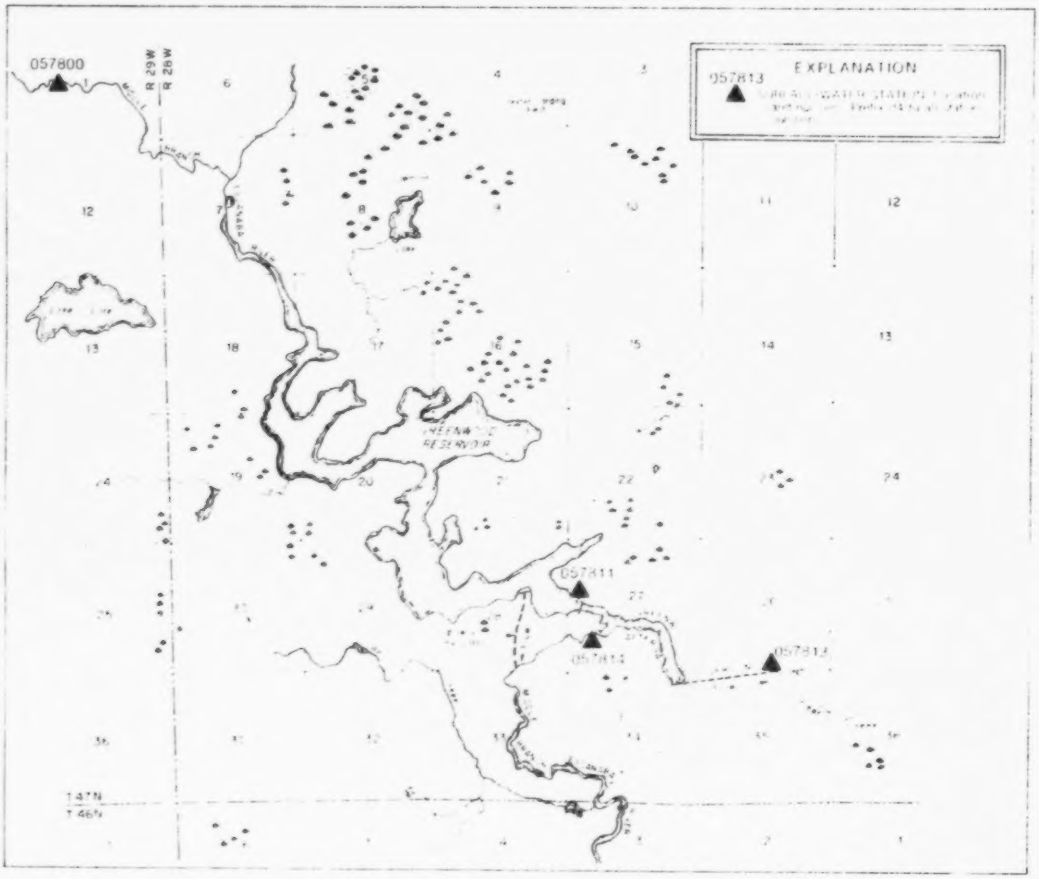


Figure 8.--Identification number and location of active surface-water gaging stations in and around the Greenwood Reservoir Complex.

04057811 GREENWOOD RESERVOIR NEAR GREENWOOD, MI

LOCATION.--Lat 46°26'32", long 87°48'02", in NW1/4 SW1/4 sec.27, T.47 N., R.28 W., Marquette County, Hydrologic Unit 04030110, at downstream side of dam on Middle Branch Escanaba River, 3.7 mi southwest of Greenwood.

DRAINAGE AREA.--67.4 mi².

PERIOD OF RECORD.--December 1972 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,400.00 ft above National Geodetic Vertical Datum of 1929 (levels by Cleveland-Cliffs Iron Co.); gage readings have been converted to elevations NGVD. Prior to Feb. 20, 1973, nonrecording gage at same site and datum.

REMARKS.--The reservoir is formed by an earth/rockfill main dam and several earthfill dikes surrounding the storage area. Storage began Dec. 22, 1972. The fixed-crest concrete spillway was completed in September 1973. Capacity of reservoir, 23,300 acre-ft at spillway elevation 1,515 ft. Above elevation 1,515 ft, water flows over concrete spillway into Middle Branch Escanaba River about 2,000 ft downstream from Greenwood Release (station 04057814). The main dam is equipped with an outlet structure with 4 valves to control flow to afterbay (conservation pool) which has a capacity of 420 acre-ft at elevation 1,480 ft. Two outlet systems from the afterbay provide for diversion and release flow. Diverted flow to Green Creek gaged at Greenwood Diversion (station 04057813); released flow to Middle Branch Escanaba River gaged at Greenwood Release (station 04057814). Reservoir impounds water for diversion to Schweitzer Reservoir (station 04058190), for use in iron ore processing.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents, 26,520 acre-ft, Apr. 21, 22, 23, 1985, elevation, 1,517.3 ft; minimum since first filling, 3,240 acre-ft, Mar. 12, 1977, elevation, 1,491.1 ft.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 24,560 acre-ft, June 10, 11, elevation, 1,515.9 ft; minimum, 18,420 acre-ft, Sept. 30, elevation, 1,511.1 ft.

MONTHEND ELEVATION, IN FEET NGVD, AND CONTENTS AT 2400, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

Date	Elevation (feet)	Contents (acre-feet)	Change in contents (acre-feet)	(equivalent in ft³/s)
Sept. 30	1,512.3	19,860	--	--
Oct. 31	1,515.4	23,860	+4,000	+65.0
Nov. 30	1,515.4	23,860	0	0.0
Dec. 31	1,515.1	23,440	-420	-6.8
CAL YR 1988	--	--	0	0.0
Jan. 31	1,515.0	23,300	-140	-2.3
Feb. 28	1,514.2	22,260	-1,040	-18.7
Mar. 31	1,513.1	20,830	-1,430	-23.3
Apr. 30	1,515.3	23,720	+2,890	+48.6
May 31	1,515.2	23,580	-140	-2.3
June 30	1,515.2	23,580	0	0.0
July 31	1,513.7	21,610	-1,970	-32.0
Aug. 31	1,512.7	20,340	-1,270	-20.7
Sept. 30	1,511.1	18,420	-1,920	-32.3
WTR YR 1989	--	--	-1,440	-2.0

04057813 GREENWOOD DIVERSION NEAR GREENWOOD, MI

LOCATION.--Lat 46°26'04", long 87°46'10", in NW1/4 NE1/4 sec.35, T.47 N., R.28 W., Marquette County, Hydrologic Unit 04030110, on left bank at downstream end of pipeline, 200 ft upstream from Green Creek, 0.7 mi downstream from Greenwood Afterbay, and 3.6 mi south of Greenwood.

PERIOD OF RECORD.--December 1972 to current year.

GAGE.--Water-stage recorder and concrete flume. Datum of gage is 1,454.57 ft above National Geodetic Vertical Datum of 1929 (Cleveland Cliffs Iron Co. bench mark). Prior to Aug. 22, 1973, nonrecording gage at same site and datum.

REMARKS.--No estimated daily discharges. Records excellent. Flow completely regulated. A pipeline, 0.7 mi long, diverts water from Greenwood Reservoir (station 04057811) into Green Creek, tributary to Schweitzer Reservoir (station 04058190). Water is used for iron ore processing; some returned to Middle Branch Escanaba River 27 mi downstream via another Green Creek; some returned 31 mi downstream via Goose Lake Outlet and East Branch Escanaba River. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 30 ft^3/s, June 25-28, 1977, Nov. 9, 1979; no flow, Dec. 27, 1972 to Jan. 6, 1973; minimum daily discharge since diversion began Jan. 7, 1973, 0.01 ft^3/s, Apr. 16, 17, 1987.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	14	5.3	.03	26	15	13	8.1	.05	5.7	15	26	26
2	14	5.3	.03	25	15	13	8.1	.05	.87	14	21	26
3	14	5.3	.03	22	15	14	8.1	.05	.92	15	15	26
4	14	5.1	.03	19	15	14	8.1	.05	.93	19	14	26
5	14	5.1	.03	19	14	14	2.3	.05	.93	20	14	26
6	14	5.3	.03	18	14	14	.03	.04	.93	23	14	26
7	6.8	5.2	.03	18	14	14	.03	.05	.93	26	14	26
8	.03	3.5	.03	18	14	14	.03	.03	.93	26	14	26
9	.03	.03	.03	18	14	14	.03	.03	.93	26	13	26
10	.03	.03	.03	18	14	14	.03	.03	.93	26	13	26
11	.03	.03	.03	18	14	14	.03	.03	.93	26	14	26
12	.03	.03	.03	18	14	14	.03	.03	.93	26	14	26
13	.03	.03	.03	18	14	11	.03	.03	.93	26	14	26
14	.03	.03	.02	17	14	7.9	.03	.03	.93	26	14	26
15	.03	.03	.02	17	14	8.0	.03	5.7	.93	26	13	26
16	.03	.03	.02	16	14	8.0	.03	15	.93	26	13	26
17	.03	.03	.02	14	14	8.0	.03	14	.93	26	13	26
18	.03	.03	.02	14	14	8.0	.03	14	.93	26	13	26
19	.03	.03	9.8	14	14	8.0	.03	14	.93	26	13	26
20	.03	.03	24	14	14	8.0	.48	14	.93	26	13	26
21	.03	.03	25	14	14	11	.03	14	.93	26	13	26
22	.03	.03	25	14	14	15	.03	15	.93	26	13	25
23	.03	.03	25	14	16	15	.03	16	.93	26	13	26
24	2.5	.03	26	14	23	15	.03	17	.93	26	13	26
25	5.6	.03	26	14	25	15	.03	17	.93	26	13	26
26	5.5	.03	26	14	25	15	.03	17	.93	26	13	26
27	5.4	.03	26	14	20	11	.03	17	.93	26	13	26
28	5.4	.03	26	14	13	8.0	.05	17	.93	26	16	26
29	5.4	.03	26	14	---	8.0	.05	17	.93	26	24	26
30	5.4	.03	26	14	---	8.0	.05	14	8.2	26	26	26
31	5.4	---	26	15	---	8.0	---	11	---	26	26	---
TOTAL	131.88	40.76	317.29	516	434	361.9	35.96	249.25	39.87	756	475	780
MEAN	4.25	1.36	10.2	16.6	15.5	11.7	1.20	8.04	1.33	24.4	15.3	26.0
MAX	14	5.3	26	26	25	15	8.1	17	8.2	26	26	26
MIN	.03	.03	.02	14	13	7.9	.03	.03	.87	14	13	26

CAL YR 1988 TOTAL 4716.71 MEAN 12.9 MAX 27 MIN .02
WTR YR 1989 TOTAL 4137.91 MEAN 11.3 MAX 26 MIN .02

04057814 GREENWOOD RELEASE NEAR GREENWOOD, MI

LOCATION.--Lat 46°26'22", long 87°47'52", in NW1/4 SW1/4 sec.27, T.47 N., R.28 W., Marquette County, Hydrologic Unit 04030110, on left bank at outlet of Greenwood Afterbay releasing to Middle Branch Escanaba River, 2.6 mi upstream from Bell Creek and 3.8 mi southwest of Greenwood.

DRAINAGE AREA.--67.4 mi^2.

PERIOD OF RECORD.--October 1972 to current year.

GAGE.--Water-stage recorder and concrete flume. Datum of gage is 1,473.77 ft above National Geodetic Vertical Datum of 1929 (Cleveland-Cliffs Iron Co. bench mark). Prior to Nov. 7, 1973, nonrecording gage at same site and different datum.

REMARKS.--Estimated daily discharges: Mar. 18-28. Records excellent except for estimated daily discharges, which are fair. Since December 1972, flow from Greenwood Reservoir (station 04057811) below spillway elevation 1,515 ft is completely regulated by the afterbay release structure into the Middle Branch Escanaba River. Since January 1973, water diverted immediately upstream from station via Greenwood Diversion (station 04057813) to Green Creek for iron ore processing and some returned to Middle Branch Escanaba River 27 mi downstream via another Green Creek. Since October 1979, some of the diversion returned 31 mi downstream via Goose Lake Outlet and East Branch Escanaba River. Overflow from reservoir spillway bypasses and returns to the Middle Branch Escanaba River 0.5 mi downstream from station. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge (prior to regulation), 290 ft^3/s, Oct. 1, 1972; (since regulation began), 63 ft^3/s, July 10, 11, 1974; minimum daily, 6.4 ft^3/s, Nov. 10, 1987, release structure closed for trash rack cleaning and flume inspection.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	25	23	25	27	27	54	58	28	27	25	25	26
2	25	23	25	27	27	55	58	27	27	23	26	26
3	25	23	25	27	27	55	59	27	27	22	27	26
4	25	22	25	26	27	55	59	27	27	22	27	26
5	25	23	25	26	27	55	59	27	27	21	27	26
6	25	23	25	26	27	55	58	27	27	22	27	26
7	25	23	25	25	27	55	58	27	27	24	27	26
8	25	23	25	25	27	55	58	27	27	25	27	26
9	25	24	25	25	27	55	58	27	27	26	27	26
10	25	24	25	25	27	55	58	27	27	26	27	26
11	25	25	25	25	27	55	58	27	27	27	27	26
12	25	25	25	25	27	55	55	27	27	27	27	26
13	25	25	25	25	27	55	53	27	27	27	27	25
14	25	25	25	25	27	55	52	27	27	28	27	25
15	25	25	25	25	27	55	51	27	27	28	26	25
16	25	25	25	25	27	55	50	25	27	28	26	25
17	25	25	25	25	27	55	50	24	27	28	26	25
18	25	25	25	25	27	56	50	23	27	27	26	25
19	25	25	25	26	27	57	39	23	27	27	26	25
20	25	25	23	26	27	58	27	23	27	26	26	25
21	25	25	21	26	27	58	28	23	27	26	25	25
22	25	25	21	26	27	58	28	25	27	25	25	25
23	25	25	25	26	37	58	28	26	27	25	25	25
24	25	25	29	26	53	58	28	27	27	25	25	25
25	25	25	29	26	53	58	28	28	27	25	25	25
26	25	25	29	26	53	58	28	28	27	24	25	25
27	25	25	29	26	53	58	28	28	27	24	25	25
28	24	25	29	27	53	58	28	27	27	23	25	25
29	24	25	28	27	---	59	28	27	27	23	25	25
30	24	25	28	27	---	59	28	27	27	23	26	25
31	23	---	28	27	---	58	---	27	---	23	26	---
TOTAL	770	731	794	801	896	1745	1348	817	810	775	808	762
MEAN	24.8	24.4	25.6	25.8	32.0	56.3	44.9	26.4	27.0	25.0	26.1	25.4
MAX	25	25	29	27	53	59	59	28	27	28	27	26
MIN	23	22	21	25	27	54	27	23	27	21	25	25

CAL YR 1988	TOTAL 10352	MEAN 28.3	MAX 59	MIN 20
WTR YR 1989	TOTAL 11057	MEAN 30.3	MAX 59	MIN 21

04058190 SCHWEITZER RESERVOIR NEAR PALMER, MI

LOCATION.--Lat 46°25'00", long 87°38'48", in SE1/4 NW1/4 sec.2, T.46 N., R.27 W., Marquette County, Hydrologic Unit 04030110, on left bank 120 ft upstream from dam on Schweitzer Creek, 3.0 mi southwest of Palmer.

DRAINAGE AREA.--23.1 mi².

PERIOD OF RECORD.--January 1963 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,300.00 ft above National Geodetic Vertical Datum of 1929 (Cleveland-Cliffs Iron Co. reference mark); gage readings have been converted to elevations NGVD. Prior to Oct. 25, 1967, nonrecording gage at same site and datum.

REMARKS.--Reservoir is formed by an earthfill dam with fixed crest concrete spillway completed in 1963. Capacity of reservoir, 5,300 acre-ft at spillway elevation, 1,338.00 ft. The dam includes a discharge pipe equipped with valve to control release flow to Schweitzer Creek (station 04058200). An average of 1.9 ft³/s was diverted from the headwaters of basin by the City of Ishpeming for municipal supply and the effluent discharged to the Carp River basin. An average of 27 ft³/s was diverted from reservoir for iron ore processing, some returned to Middle Branch Escanaba River basin via Green Creek and some returned to the East Branch Escanaba River basin via Goose Lake Outlet. Since January 1973, controlled diversion from Greenwood Reservoir (station 04057811) via Greenwood Diversion (station 04057813) into Schweitzer Reservoir. Controlled inflow averaged 11.3 ft³/s for the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents recorded, 5,900 acre-ft, May 31, 1970, Apr. 20, 1985, elevation, 1,339.5 ft; minimum recorded since first filling, 2,920 acre-ft, Apr. 10, 1974, elevation, 1,329.7 ft.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 5,580 acre-ft, June 9, elevation, 1,338.7 ft; minimum, 4,380 acre-ft, Mar. 23, elevation, 1,335.1 ft.

MONTHEND ELEVATION, IN FEET NGVD, AND CONTENTS AT 2400, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

Date	Elevation (feet)	Contents (acre-feet)	Change in contents (acre-feet)	Change in contents (equivalent in ft³/s)
Sept. 30	1,337.6	5,160	--	--
Oct. 31	1,338.1	5,340	+180	+2.9
Nov. 30	1,338.2	5,380	+40	+0.7
Dec. 31	1,338.3	5,420	+40	+0.6
CAL YR 1988	--	--	+440	+0.6
Jan. 31	1,337.4	5,090	-330	-5.4
Feb. 28	1,336.7	4,860	-230	-4.1
Mar. 31	1,336.7	4,860	0	0.0
Apr. 30	1,338.1	5,340	+480	+8.1
May 31	1,338.2	5,380	+40	+0.6
June 30	1,337.4	5,090	-290	-4.9
July 31	1,337.5	5,120	+30	+0.5
Aug. 31	1,336.5	4,800	-320	-5.2
Sept. 30	1,337.2	5,020	+220	+3.7
WTR YR 1989	--	--	-140	-0.2

04058200 SCHWEITZER CREEK NEAR PALMER, MI

LOCATION.--Lat 46°24'40", long 87°37'27", in SW1/4 sec.1, T.46 N., R.27 W., Marquette County, Hydrologic Unit 04030110, on right bank 10 ft upstream from highway bridge, 2.5 mi southwest of Palmer.

DRAINAGE AREA.--23.6 mi^2.

PERIOD OF RECORD.--October 1960 to current year.

GAGE.--Water-stage recorder. Concrete control since Oct. 1, 1963. Datum of gage is 1,268.28 ft above National Geodetic Vertical Datum of 1929, (Cleveland-Cliffs Iron Co. bench mark). Prior to Aug 21, 1961, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 10-14, Dec. 27 to Jan. 11, 14-19, Feb. 3-8, 17-26, Mar. 1-5, 7, July 14-18, July 28 to Aug. 15, and Aug. 22 to Sept. 30. Records good except for periods with ice effect, Dec. 10-14, Jan. 14-19, Feb. 3-8, 17-26, and Mar. 1-5, 7, which are fair, period of no gage-height record, Dec. 27 to Jan. 11, and periods of indefinite stage-discharge relation, July 14-18, July 28 to Aug. 15 and Aug. 22 to Sept. 30, which are poor. Since August 1962, flow completely regulated by Schweitzer Reservoir (station 04058190) 1.0 mi upstream. An average of 1.9 ft^3/s was diverted from headwaters of basin by the City of Ishpeming for municipal supply (furnished by City of Ishpeming) and the effluent discharged to the Carp River basin. An average of 27 ft^3/s was diverted from Schweitzer Reservoir by industry for iron ore processing (furnished by Cleveland Cliffs Iron Co.), some returned to the Middle Branch Escanaba River via Green Creek and some returned via Goose Lake Outlet and East Branch Escanaba River. Diversion into Schweitzer Reservoir from Greenwood Reservoir (station 04057811) via Greenwood Diversion (station 04057813). Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 860 ft^3/s, May 31, 1970, gage height, 6.50 ft: minimum, 0.4 ft^3/s, Sept. 6, 1962, gage height, 1.22 ft; minimum daily, 1.0 ft^3/s, Apr. 9-18, May 5, 6, 1963.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 218 ft^3/s, June 9, gage height, 4.72 ft; minimum daily, 3.8 ft^3/s, Aug. 18, 19, but may have been less during period of indefinite stage-discharge relation.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.8	16	25	34	4.2	4.0	5.1	14	24	4.5	4.2	4.0
2	3.9	10	19	34	4.2	4.0	5.6	9.8	17	4.7	4.2	4.0
3	4.1	8.7	16	29	4.2	4.0	5.9	7.9	8.2	4.6	4.2	4.0
4	4.9	11	12	26	4.2	4.0	6.4	6.1	5.0	4.4	4.4	4.0
5	4.7	63	9.4	23	4.2	4.0	6.1	6.5	4.6	4.4	4.2	4.0
6	4.4	115	8.6	20	4.1	4.0	11	5.2	4.5	4.4	4.2	4.0
7	7.7	85	6.7	19	4.1	4.0	32	4.9	5.2	4.4	4.2	4.0
8	7.3	64	5.8	19	4.1	4.0	40	4.7	42	4.4	4.2	4.7
9	4.6	44	5.0	14	4.1	4.1	29	4.5	194	4.3	4.3	4.2
10	4.6	42	4.8	12	4.0	4.1	20	4.5	108	4.4	4.2	4.0
11	4.6	39	4.7	8.4	4.0	4.1	15	4.3	52	4.3	4.2	4.0
12	4.4	30	4.7	8.2	4.0	4.0	12	4.4	28	4.3	4.2	4.0
13	4.3	24	4.6	7.1	4.0	4.0	8.3	4.4	48	4.4	4.3	4.0
14	4.2	21	4.6	6.4	4.0	4.1	7.2	4.4	86	4.4	4.4	4.0
15	4.2	18	4.6	5.7	4.0	4.1	8.7	4.4	77	4.4	4.2	4.0
16	4.7	66	4.7	5.1	4.0	4.0	16	4.4	46	4.6	4.0	3.9
17	4.6	134	4.6	4.7	4.0	3.9	32	4.4	31	4.4	4.1	3.9
18	4.6	73	4.6	4.5	4.0	4.0	39	4.4	20	4.4	3.8	3.9
19	4.5	46	4.6	4.4	4.0	4.0	35	4.4	13	5.4	3.8	3.9
20	4.4	38	4.7	4.4	4.0	4.0	32	4.4	8.6	4.4	4.1	3.9
21	4.6	29	4.6	4.4	4.0	3.9	29	4.4	5.3	4.3	3.9	3.9
22	4.5	23	4.6	4.4	4.0	4.0	29	4.3	4.9	4.3	4.0	3.9
23	4.9	18	4.6	4.4	4.0	4.1	28	4.3	5.9	4.2	4.0	3.9
24	5.4	15	4.6	4.4	4.0	4.1	27	4.5	5.1	4.3	4.0	3.9
25	12	13	4.6	4.4	4.0	4.7	27	6.4	4.9	4.2	4.0	3.9
26	19	16	4.6	4.4	4.0	5.0	43	4.8	4.9	4.2	4.0	3.9
27	19	35	6.1	4.4	4.0	6.7	41	4.6	4.8	4.5	4.1	3.9
28	36	60	12	4.4	4.0	7.1	29	4.5	4.6	4.2	4.2	3.9
29	30	47	14	4.4	---	5.8	20	4.6	4.6	4.2	4.1	3.9
30	18	35	19	4.4	---	5.2	18	4.7	4.6	4.2	4.0	3.9
31	13	---	28	4.4	---	5.1	---	12	---	4.2	4.0	---
TOTAL	261.9	1238.7	265.4	337.3	113.4	136.1	657.3	171.1	871.7	136.3	127.7	119.4
MEAN	8.45	41.3	8.56	10.9	4.05	4.39	21.9	5.52	29.1	4.40	4.12	3.98
MAX	36	134	28	34	4.2	7.1	43	14	194	5.4	4.4	4.7
MIN	3.9	8.7	4.6	4.4	4.0	3.9	5.1	4.3	4.5	4.2	3.8	3.9

CAL YR 1988 TOTAL 4214.0 MEAN 11.5 MAX 241 MIN 3.7
WTR YR 1989 TOTAL 4436.3 MEAN 12.2 MAX 194 MIN 3.8

04058940 ESCANABA RIVER NEAR ST. NICHOLAS, MI

LOCATION.--Lat 45°58'45", long 87°16'13", in SW1/4 NE1/4 sec.2, T.41 N., R.24 W., Delta County, Hydrologic Unit 04030110, on right bank 600 ft downstream from Boney Falls Dam, 2.1 mi west of St. Nicholas and 23.1 mi upstream from mouth.

DRAINAGE AREA.--Not determined.

PERIOD OF RECORD.--December 1987 to current year (gage heights only).

GAGE.--Water-stage recorder. Elevation of gage is 875.0 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Diurnal fluctuation caused by hydroelectric plant 600 ft upstream. Some regulation by Schweitzer Reservoir (station 04058190) about 40 mi upstream and Greenwood Reservoir (station 04057811) about 50 mi upstream. Because storage capacity is small, daily flows are not affected appreciably. Gage height telemeter at station.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height recorded, 5.11 ft, Apr. 7, 1988, but may have been higher during period of no gage height record, Apr. 8-14, 1988; minimum daily, 2.03 ft, July 4, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 4.64 ft, June 10, 11; minimum daily, 2.11 ft, Sept. 21, 30.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.43	3.10	---	2.40	2.35	---	3.26	3.55	3.28	2.81	2.21	2.45
2	2.33	3.01	---	2.39	2.33	---	3.39	3.40	3.34	2.71	2.21	2.47
3	2.22	3.09	---	2.35	2.30	---	3.38	3.29	3.36	2.53	2.18	2.39
4	2.29	2.99	---	2.34	2.31	---	3.73	3.23	3.23	2.64	2.18	2.30
5	2.59	3.63	---	2.34	2.31	---	3.92	3.20	2.98	2.58	2.18	2.27
6	2.77	4.14	---	2.36	2.30	---	3.95	3.18	2.85	2.53	2.18	2.27
7	2.76	4.45	2.91	2.37	2.30	---	3.97	---	2.83	2.46	2.15	2.23
8	2.74	4.45	2.68	2.38	2.29	---	4.00	---	3.18	2.41	2.15	2.22
9	2.43	4.30	2.59	2.36	2.27	---	3.79	---	4.18	2.35	2.15	2.19
10	2.38	3.91	2.33	2.36	2.28	---	3.62	---	4.56	2.32	2.15	2.17
11	2.65	3.90	2.36	2.37	2.28	---	3.50	---	4.60	2.30	2.15	2.22
12	2.53	3.75	2.33	2.39	2.28	---	3.41	---	4.33	2.28	2.17	2.25
13	2.50	3.64	2.46	2.39	2.29	---	3.26	---	4.07	2.25	2.22	2.31
14	2.45	3.52	2.48	2.36	2.27	---	3.26	---	4.14	2.36	2.28	2.26
15	2.44	3.46	2.36	2.38	2.25	---	3.32	---	4.25	2.40	2.38	2.23
16	2.44	3.61	2.29	2.29	2.24	---	3.48	---	4.18	2.41	2.24	2.22
17	2.63	3.95	2.43	2.25	2.24	---	3.72	---	4.09	2.38	2.41	2.19
18	2.75	4.05	2.44	2.41	2.24	---	3.83	---	3.91	2.35	2.20	2.17
19	2.79	4.05	2.46	2.38	2.23	---	3.84	---	3.66	2.37	2.16	2.15
20	2.83	3.88	2.56	2.38	2.23	---	3.83	---	3.40	2.26	2.17	2.12
21	2.69	3.68	2.54	2.34	2.23	---	3.80	---	3.17	2.22	2.16	2.11
22	2.73	3.56	2.53	2.35	2.20	---	3.77	---	2.98	2.21	2.25	2.16
23	2.70	3.36	2.60	2.36	2.20	---	3.77	---	3.09	2.20	2.26	2.13
24	2.89	3.23	2.58	2.38	---	2.35	3.69	---	3.49	2.18	2.21	2.12
25	3.09	3.17	2.56	2.36	---	2.40	3.70	---	3.41	2.17	2.16	2.13
26	3.10	3.13	2.51	2.37	---	2.37	3.85	3.50	3.34	2.15	2.15	2.12
27	3.02	3.43	2.53	2.34	---	2.83	3.94	3.59	3.38	2.18	2.15	2.13
28	3.18	3.82	2.45	2.37	---	3.05	3.91	3.31	3.19	2.20	2.14	2.13
29	3.43	3.87	2.42	2.35	---	3.36	3.72	3.12	2.99	2.21	2.14	2.13
30	3.35	3.75	2.42	2.36	---	3.38	3.48	2.97	2.87	2.21	2.13	2.11
31	3.17	---	2.40	2.36	---	3.34	---	3.14	---	2.21	2.24	---
MEAN	2.72	3.66	---	2.36	---	---	3.67	---	3.54	2.35	2.20	2.21
MAX	3.43	4.45	---	2.41	---	---	4.00	---	4.60	2.81	2.41	2.47
MIN	2.22	2.99	---	2.25	---	---	3.26	---	2.83	2.15	2.13	2.11

04059000 ESCANABA RIVER AT CORNELL, MI
(National stream quality accounting network station)

LOCATION.--Lat 45°54'31", long 87°12'49", in NW1/4 sec.32, T.41 N., R.23 W., Delta County, Hydrologic Unit 04030110, on right bank 50 ft downstream from bridge on County Road 519, 0.4 mi downstream from Bobs Creek, 0.7 mi northeast of Cornell, and 16 mi upstream from mouth.

DRAINAGE AREA.--870 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--August 1903 to December 1912, January 1913 to November 1915 (gage heights only), October 1950 to current year. Monthly discharge only for some periods, published in WSP 1307. Published as "near Escanaba" 1903-15.

REVISED RECORDS.--WSP 1387: 1904. WDR MI-85: 1970 (M).

GAGE.--Water-stage recorder. Datum of gage is 749.26 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). August 1903 to November 1915, nonrecording gage at site 10 mi downstream at different datum.

REMARKS.--Estimated daily discharges: Dec. 5 to Apr. 4. Water-discharge records good except for estimated daily discharges, which are fair. Since 1950, diurnal fluctuation and occasional slight regulation by Boney Falls powerplant 7 mi upstream. Since August 1962, some regulation by Schweitzer Reservoir (station 04058190) about 50 mi upstream. Since December 1972, some regulation by Greenwood Reservoir (station 04057811) about 60 mi upstream. Gage-height telemeter at station.

AVERAGE DISCHARGE.--48 years (water years 1904-12, 1951-89), 885 ft³/s, 13.81 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 10,700 ft³/s, Apr. 26, 1979, gage height, 5.00 ft; maximum gage height, 6.40 ft, Apr. 9, 1971, backwater from ice; minimum discharge observed, 90 ft³/s, July 5, 1910, gage height, 1.5 ft, site and datum then in use, but may have been less during extended periods of no gage-height record during winter periods of 1903-12, or periods of ice effect in 1959.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,950 ft³/s, Nov. 7, gage height, 3.41 ft; maximum gage height, 5.18 ft, Apr. 4, backwater from ice; minimum daily discharge, 239 ft³/s, Sept. 21.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	509	1240	1950	520	470	340	1500	1810	1890	937	300	489
2	451	1120	1900	515	450	350	1700	1630	1710	826	298	543
3	370	1240	1760	500	430	345	1650	1490	1630	658	299	465
4	421	1220	1450	490	430	340	2500	1410	1440	708	303	393
5	643	2250	1300	480	430	340	2790	1400	1160	660	286	365
6	829	3250	1150	505	430	340	2810	1370	1020	610	279	361
7	814	3790	950	505	425	340	2700	1320	968	551	268	330
8	832	3730	800	505	420	345	2650	1220	1830	501	262	315
9	559	3310	650	500	400	350	2260	1160	3330	460	261	302
10	507	2800	520	500	420	355	2110	1090	3760	424	265	293
11	726	2470	540	505	410	365	1870	987	3590	412	261	312
12	622	2170	520	510	410	375	1740	856	3080	394	270	338
13	603	2070	650	510	430	380	1580	814	2690	367	303	381
14	551	1890	650	500	400	380	1660	790	2800	421	353	358
15	533	1810	520	505	380	400	1750	777	3180	458	428	332
16	539	2420	450	450	380	400	1960	740	2970	471	349	316
17	689	2700	560	400	380	400	2330	690	2820	459	429	298
18	833	2770	580	520	375	400	2410	668	2530	421	334	281
19	889	2720	610	500	370	400	2370	648	2160	422	275	271
20	909	2460	700	500	365	400	2340	668	1830	348	281	261
21	806	2150	680	460	370	400	2270	702	1520	328	272	239
22	825	1910	680	480	345	410	2190	679	1260	313	332	275
23	819	1650	750	500	340	430	2170	653	1470	291	344	259
24	1030	1480	720	510	340	465	2030	676	1930	288	309	255
25	1240	1430	700	500	335	505	2030	1510	1770	278	287	253
26	1280	1390	650	480	335	485	2240	1790	1620	268	274	254
27	1250	2160	670	470	335	880	2380	2040	1610	289	270	258
28	1460	2540	600	490	335	1110	2320	1780	1410	294	263	257
29	1640	2490	550	470	---	1700	2120	1390	1160	308	261	252
30	1510	2270	540	480	---	1700	1950	1310	1020	307	255	246
31	1330	---	520	480	---	1600	---	1890	---	306	318	---
TOTAL	26019	66900	25270	15240	10940	17030	64380	35958	61158	13778	9289	9552
MEAN	839	2230	815	492	391	549	2146	1160	2039	444	300	318
MAX	1640	3790	1950	520	470	1700	2810	2040	3760	937	429	543
MIN	370	1120	450	400	335	340	1500	648	968	268	255	239
CFSM	.96	2.56	.94	.57	.45	.63	2.47	1.33	2.34	.51	.35	.37
IN.	1.11	2.86	1.08	.65	.47	.73	2.75	1.54	2.62	.59	.40	.41

CAL YR 1988 TOTAL 301910 MEAN 825 MAX 6220 MIN 153 CFSM .95 IN 12.91
WTR YR 1989 TOTAL 355514 MEAN 974 MAX 3790 MIN 239 CFSM 1.12 IN 15.20

04059000 ESCANABA RIVER AT CORNELL, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1969-73, 1975 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: February 1975 to September 1981.
WATER TEMPERATURE: February 1975 to September 1981.

INSTRUMENTATION.--Water-quality monitor from Oct. 15, 1975 to Sept. 30, 1981.

REMARKS.--Bimonthly cross-sectional samples were collected at or near bridge. From October 1975 to September 1981, instrument-recorded specific conductance below 200 microsiemens does not represent the conductance of the cross section. Results of a study of conductance in the cross section are available in the District files.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1975, 1978-81): Maximum daily recorded (more than 20 percent missing record), 360 microsiemens, Sept. 10, 1975; minimum measured, 114 microsiemens, Apr. 15, 1981.
WATER TEMPERATURE (water years 1975, 1977-81): Maximum daily recorded (more than 20 percent missing record), 35.0°C, July 31, 1975; minimum, 0.0°C on many days during winter.

EXTREMES OUTSIDE PERIOD OF DAILY RECORD.--A specific conductance of 72 microsiemens was measured Apr. 24, 1985.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
OCT 18...	1245	903	205	8.30	8.0	2.4	11.6	101	K20	K18
DEC 19...	1115	611	237	7.97	0.0	2.0	14.2	102	K7	330
FEB 22...	1540	348	327	7.99	0.0	2.3	15.0	104	<2	<2
APR 26...	1300	2200	130	7.92	8.0	1.0	11.5	100	K6	<5
JUN 27...	1320	1660	169	8.30	21.0	2.0	8.6	100	K21	280
AUG 29...	1345	261	308	8.65	24.5	1.7	9.2	115	K9	K8

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
OCT 18...	82	0	19	8.5	16	29	0.8	1.1	104	0
DEC 19...	97	4	23	9.7	14	24	0.6	1.2	113	0
FEB 22...	100	0	23	11	29	38	1	1.6	156	0
APR 26...	60	9	14	6.0	5.2	16	0.3	0.9	62	0
JUN 27...	83	6	20	8.0	5.8	13	0.3	0.8	94	0
AUG 29...	100	0	24	10	32	40	1	1.6	145	7

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
OCT 18...	85	14	6.8	0.1	9.5	148	0.20	361	<0.01	<0.10
DEC 19...	93	19	6.3	0.1	11	146	0.20	241	0.01	0.27
FEB 22...	128	22	10	0.1	13	191	0.26	179	<0.01	0.22
APR 26...	51	8.7	3.4	0.1	5.5	97	0.13	576	<0.01	0.13
JUN 27...	77	5.0	3.5	0.1	6.2	137	0.19	614	<0.01	0.12
AUG 29...	[illegible]	17	10	0.2	[illegible]	182	0.25	128	<0.01	<0.10

04059000 ESCANABA RIVER AT CORNELL, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N)	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHOROUS TOTAL (MG/L AS P)	PHOS-PHOROUS DIS-SOLVED (MG/L AS P)	PHOS-PHOROUS ORTHO, DIS-SOLVED (MG/L AS P)	ALUM-INUM, DIS-SOLVED (UG/L AS AL)	ARSENIC DIS-SOLVED (UG/L AS AS)	BARIUM, DIS-SOLVED (UG/L AS BA)	BERYL-LIUM, DIS-SOLVED (UG/L AS BE)
OCT 18...	0.02	0.01	0.50	0.02	0.01	<0.01	40	1	10	<0.5
DEC 19...	0.03	0.03	0.60	0.01	0.01	0.01	30	<1	12	<0.5
FEB 22...	0.01	<0.01	0.40	0.01	<0.01	<0.01	--	--	--	--
APR 26...	0.05	0.04	0.30	0.01	<0.01	<0.01	40	<1	9	<0.5
JUN 27...	0.06	0.04	0.60	0.02	0.01	<0.01	50	<1	10	<0.5
AUG 29...	--	0.02	0.40	<0.01	<0.01	<0.01	--	--	--	--

DATE	CADMIUM DIS-SOLVED (UG/L AS CD)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COBALT, DIS-SOLVED (UG/L AS CO)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, DIS-SOLVED (UG/L AS FE)	LEAD, DIS-SOLVED (UG/L AS PB)	LITHIUM DIS-SOLVED (UG/L AS LI)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY DIS-SOLVED (UG/L AS HG)	MOLYB-DENUM, DIS-SOLVED (UG/L AS MO)
OCT 18...	<1	<1	<3	3	400	<5	<4	12	<0.1	<10
DEC 19...	<1	<1	<3	2	380	<5	4	21	<0.1	<10
FEB 22...	--	--	--	--	--	--	--	--	--	--
APR 26...	<1	<1	<3	3	340	8	<4	13	0.1	<10
JUN 27...	<1	<1	3	5	550	4	<4	34	0.2	<10
AUG 29...	--	--	--	--	--	--	--	--	--	--

DATE	NICKEL, DIS-SOLVED (UG/L AS NI)	SELE-NIUM, DIS-SOLVED (UG/L AS SE)	SILVER, DIS-SOLVED (UG/L AS AG)	STRON-TIUM, DIS-SOLVED (UG/L AS SR)	VANA-DIUM, DIS-SOLVED (UG/L AS V)	ZINC, DIS-SOLVED (UG/L AS ZN)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
OCT 18...	2	<1	1.0	35	<6	4	4	9.8	46
DEC 19...	<1	<1	<1.0	53	<6	14	2	3.3	100
FEB 22...	--	--	--	--	--	--	4	3.8	65
APR 26...	<1	<1	1.0	29	<6	9	4	24	60
JUN 27...	<1	<1	<1.0	38	<6	6	4	18	77
AUG 29...	--	--	--	--	--	--	5	3.5	86

04059500 FORD RIVER NEAR HYDE, MI
(National stream quality accounting network station)

LOCATION.--Lat 45°45'20", long 87°12'05", in SW1/4 sec.19, T.39 N., R.23 W., Delta County, Hydrologic Unit 04030109, on right bank 40 ft downstream from bridge on County Road 533, 1.4 mi downstream from Tenmile Creek, and 1.5 mi north of Hyde.

DRAINAGE AREA.--450 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1954 to current year.

GAGE.--Water-stage recorder. Datum of gage is 681.77 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 3 to Mar. 30. Water-discharge records good except for estimated daily discharges, which are fair.

AVERAGE DISCHARGE.--35 years, 384 ft³/s, 11.59 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,590 ft³/s, May 7, 1960, gage height, 8.27 ft; minimum, 18 ft³/s, Aug. 30, 1976, July 7, 8, 1988; minimum gage height, 1.30 ft, July 7, 8, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,840 ft³/s, Apr. 7, gage height, 5.58 ft; maximum gage height, 6.38 ft, Mar. 30, backwater from ice; minimum discharge, 40 ft³/s, Sept. 30, gage height, 1.53 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	153	480	950	170	130	71	1150	834	832	458	85	65
2	140	436	795	165	130	71	1250	748	787	375	79	133
3	137	393	680	160	125	70	1430	687	760	319	76	168
4	134	379	590	150	120	70	1540	639	679	289	77	153
5	140	541	520	145	110	70	1760	662	576	256	70	131
6	153	869	490	140	105	70	1820	689	502	220	62	116
7	167	1030	430	140	99	71	1920	661	429	192	57	106
8	160	1090	350	140	93	72	1850	623	482	176	53	99
9	149	1120	280	135	89	72	1420	570	1230	163	51	99
10	137	1110	220	130	85	73	1230	512	1440	144	49	90
11	128	1020	200	130	82	74	1110	465	1320	130	54	82
12	118	899	195	130	81	78	951	427	1250	120	54	78
13	111	849	195	130	81	80	835	392	1310	107	81	78
14	106	766	205	130	81	80	837	369	1310	97	133	73
15	102	701	210	130	80	80	903	352	1490	90	174	71
16	102	952	205	130	78	82	965	336	1430	84	177	71
17	110	1140	205	130	75	82	1100	322	1460	87	166	68
18	140	1120	200	128	73	82	1160	308	1450	82	144	66
19	181	1080	200	125	73	80	1150	294	1250	83	124	61
20	207	1080	200	125	73	78	1130	296	1030	79	106	55
21	212	995	200	125	73	78	1090	309	806	75	95	54
22	206	879	200	125	73	78	1030	303	639	70	91	54
23	205	762	205	125	72	80	966	289	632	65	97	50
24	253	666	205	125	72	110	909	289	872	60	87	46
25	321	597	200	125	72	160	874	576	1130	57	77	44
26	390	586	200	125	72	280	903	877	1200	55	73	42
27	436	813	200	130	72	500	944	896	1130	64	68	41
28	501	1180	195	130	71	810	959	848	952	73	62	41
29	533	1200	185	130	---	1600	950	754	746	75	58	41
30	524	1110	180	130	---	1750	915	659	578	90	53	41
31	502	---	170	130	---	1120	---	787	---	91	54	---
TOTAL	6858	25843	9460	4163	2440	8072	35051	16773	29702	4326	2687	2317
MEAN	221	861	305	134	87.1	260	1168	541	990	140	86.7	77.2
MAX	533	1200	950	170	130	1750	1920	896	1490	458	177	168
MIN	102	379	170	125	71	70	835	289	429	55	49	41
CFSM	.49	1.91	.68	.30	.19	.58	2.60	1.20	2.20	.31	.19	.17
IN.	.57	2.14	.78	.34	.20	.67	2.90	1.39	2.46	.36	.22	.19

CAL YR 1988 TOTAL 109015 MEAN 298 MAX 3150 MIN 20 CFSM .66 IN 9.01
WTR YR 1989 TOTAL 147692 MEAN 405 MAX 1920 MIN 41 CFSM .90 IN 12.21

04059500 FORD RIVER NEAR HYDE, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1956 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: December 1974 to September 1981.
WATER TEMPERATURE: July 1956 to September 1981.

INSTRUMENTATION.--Water-temperature recorder from July 20, 1956 to Sept. 30, 1975. Water quality monitor from Oct. 1, 1975 to Sept. 30, 1981.

REMARKS.--Quarterly cross-sectional samples were collected at or near bridge.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1975-77, 1979-81): Maximum, 482 microsiemens, Dec. 2, 1976; minimum recorded, 131 microsiemens, May 22, 1976, but may have been lower during instrument malfunction May 18-21, 1976.
WATER TEMPERATURE (water years 1956-81): Maximum, 31.0°C, July 31, 1975; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
OCT										
17...	1445	114	310	8.46	9.0	1.1	11.5	103	K8	K14
JAN										
18...	1445	128	361	7.95	0.0	1.0	10.4	74	K4	K5
APR										
25...	1430	890	220	8.15	9.0	0.6	11.5	102	K8	K7
JUL										
20...	1400	76	341	8.60	22.0	0.2	9.5	112	K11	K11

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
OCT										
17...	190	40	42	20	1.8	2	0.1	0.8	174	2
JAN										
18...	210	40	48	21	1.8	2	0.1	0.7	203	0
APR										
25...	120	22	28	13	1.1	2	0.0	0.7	125	0
JUL										
20...	200	29	46	21	1.7	2	0.0	0.9	205	2

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
OCT										
17...	147	18	2.6	<0.1	7.6	205	0.28	63.1	<0.01	<0.10
JAN										
18...	166	22	2.4	<0.1	9.9	221	0.30	76.4	<0.01	0.21
APR										
25...	102	12	1.8	0.1	3.7	145	0.20	348	<0.01	<0.10
JUL										
20...	172	9.0	2.4	0.1	6.0	206	0.28	42.3	<0.01	<0.10

04059500 FORD RIVER NEAR HYDE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
OCT										
17...	0.02	0.03	0.50	0.02	0.01	--	<10	<1	12	<0.5
JAN										
18...	0.04	0.04	0.40	<0.01	<0.01	<0.01	10	<1	13	<0.5
APR										
25...	0.02	0.03	0.90	0.01	<0.01	<0.01	<10	<1	11	<0.5
JUL										
20...	0.02	--	0.50	0.01	0.01	<0.01	<10	1	13	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
OCT										
17...	<1	<1	<3	2	110	<5	5	7	<0.1	<10
JAN										
18...	<1	<1	<3	1	160	<5	<4	11	<0.1	<10
APR										
25...	<1	<1	<3	3	64	5	<4	6	<0.1	<10
JUL										
20...	<1	<1	<3	2	39	1	<4	20	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
OCT									
17...	<1	<1	<1.0	55	<6	6	3	0.92	30
JAN									
18...	<1	<1	<1.0	58	<6	18	1	0.35	100
APR									
25...	3	<1	<1.0	34	<6	7	6	14	56
JUL									
20...	<1	<1	<1.0	66	<6	26	2	0.41	75

04061000 BRULE RIVER NEAR FLORENCE, WI

LOCATION.--Lat 45°57'31", long 88°15'57", in SE1/4 SE1/4 sec.11, T.41 N., R.32 W., Michigan Meridian, Iron County, Hydrologic Unit 04030106, on left bank 40 ft upstream from highway bridge, 1.0 mi upstream from Paint River, 2.5 mi north of Florence, WI, and 5.0 mi upstream from confluence with Michigamme River.

DRAINAGE AREA.--389 mi^2.

PERIOD OF RECORD.--January 1914 to February 1916, June 1944 to current year.

REVISED RECORDS.--WSP 1387: 1914-16. WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,200.55 ft above National Geodetic Vertical Datum of 1929 (levels by Owen Ayres Associates). Prior to Aug. 29, 1944, nonrecording gage at bridge 40 ft downstream at same datum.

REMARKS.--Estimated daily discharges: Dec. 1 to Apr. 2. Records excellent except for estimated daily discharges, which are fair. Discharge includes some mine pumpage prior to August 1977. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--46 years (water years 1915, 1945-89), 359 ft^3/s, 12.53 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,700 ft^3/s, July 2, 1953, gage height, 6.57 ft; maximum gage height, 8.60 ft, Dec. 20, 1983, backwater from ice; minimum discharge, 118 ft^3/s, Dec. 2, 1963 (discharge measurement); minimum gage height, 1.76 ft, July 29, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 717 ft^3/s, Nov. 17, gage height, 2.96 ft; maximum gage height, 6.45 ft, Dec. 4, backwater from ice; minimum discharge, 158 ft^3/s, Aug. 12, gage height, 1.78 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	220	247	330	205	242	220	460	354	350	213	190	321
2	214	241	320	200	232	220	450	338	327	207	183	263
3	199	233	310	200	230	220	476	332	316	214	177	230
4	198	248	305	198	230	220	561	315	292	201	178	191
5	198	503	280	195	230	220	660	313	268	191	199	191
6	200	588	265	195	230	215	661	324	260	188	179	188
7	198	479	250	195	230	215	650	310	260	185	172	188
8	199	405	240	198	230	212	645	300	325	182	167	185
9	191	370	225	205	230	212	590	293	440	181	163	185
10	189	354	215	210	230	212	514	281	418	187	162	183
11	189	344	210	220	228	212	472	274	352	182	161	182
12	188	321	220	230	225	212	434	268	314	179	164	185
13	190	314	230	240	222	212	398	263	356	181	204	181
14	186	310	240	240	220	212	390	270	512	177	300	177
15	189	304	240	240	220	210	408	283	519	174	280	172
16	193	502	240	240	220	210	425	281	445	171	237	171
17	209	705	235	240	219	210	492	270	376	174	204	181
18	215	614	230	240	219	210	521	257	328	176	185	169
19	216	504	230	242	219	205	497	273	295	184	174	170
20	211	444	235	245	218	205	459	312	275	181	173	172
21	212	397	240	248	218	200	430	331	260	175	173	175
22	213	347	240	248	218	200	413	299	251	171	181	164
23	224	320	240	250	219	200	396	273	263	168	187	162
24	273	302	240	250	220	210	387	266	261	168	181	166
25	318	294	240	253	220	230	390	385	259	167	180	167
26	298	300	235	250	221	260	419	413	240	167	175	166
27	287	356	230	250	222	350	423	344	234	178	171	167
28	323	410	225	248	222	620	399	298	225	215	168	169
29	293	367	220	245	---	580	378	273	220	190	170	165
30	259	347	215	245	---	540	363	292	216	196	163	165
31	260	---	210	245	---	490	---	327	---	198	220	---
TOTAL	6952	11470	7585	7110	6284	8144	14161	9412	9457	5721	5821	5551
MEAN	224	382	245	229	224	263	472	304	315	185	188	185
MAX	323	705	330	253	242	620	661	413	519	215	300	321
MIN	186	233	210	195	218	200	363	257	216	167	161	162
CFSM	.58	.98	.63	.59	.58	.68	1.21	.78	.81	.48	.48	.48
IN.	.66	1.10	.73	.68	.60	.78	1.35	.90	.90	.55	.56	.53

CAL YR 1988 TOTAL 94253 MEAN 258 MAX 1080 MIN 158 CFSM .66 IN 9.01
WTR YR 1989 TOTAL 97668 MEAN 268 MAX 705 MIN 161 CFSM .69 IN 9.34

04061500 PAINT RIVER AT CRYSTAL FALLS, MI

LOCATION.--Lat 46°06'21", long 88°20'05", in SE1/4 sec.20, T.43 N., R.32 W., Iron County, Hydrologic Uni 04030106, on right bank 150 ft downstream from municipal powerplant at Crystal Falls, 14.5 mi upstream from mouth.

DRAINAGE AREA.--597 mi².

PERIOD OF RECORD.--August 1944 to current year.

REVISED RECORDS.--WSP 1174: 1947-48(m). WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,306.1 ft above National Geodetic Vertical Datum of 1929 (Wisconsin Electric Power Co. bench mark).

REMARKS.--Estimated daily discharges: Jan. 11 to Mar. 25. Records good. Diurnal fluctuation caused by powerplant immediately upstream; since storage capacity is small, daily flows are not affected appreciably. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--45 years, 599 ft³/s, 13.63 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 10,900 ft³/s, Apr. 25, 1960, gage height, 9.82 ft; minimum, 7.7 ft³/s, Sept. 17, 1950, gage height, 0.89 ft; minimum daily, 81 ft³/s, Nov. 1, 1947.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,100 ft³/s, June 10, gage height, 5.20 ft; minimum, 84 ft³/s, July 24, 25, gage height, 1.49 ft; minimum daily, 138 ft³/s, Sept. 24.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	363	626	703	381	307	235	804	1280	622	314	295	434
2	353	533	639	362	305	240	792	1160	692	300	294	387
3	287	546	714	373	300	260	888	1040	708	385	294	313
4	331	542	577	354	290	230	1140	938	578	280	256	250
5	323	858	596	358	285	220	1540	871	607	314	207	319
6	338	1330	609	350	290	235	1600	828	538	276	220	278
7	375	1330	575	368	290	235	1700	786	477	271	230	274
8	347	1210	470	350	285	240	1780	750	560	274	206	283
9	295	1120	398	361	270	245	1630	663	1940	217	201	294
10	417	1060	380	360	280	260	1390	601	3030	277	199	284
11	370	1010	368	350	277	255	1230	612	2710	251	223	446
12	335	918	371	350	273	270	1100	571	2100	227	174	320
13	326	857	422	345	295	270	981	488	1860	202	200	337
14	329	810	447	335	280	280	939	476	2090	240	285	283
15	299	780	424	330	275	260	1000	519	1980	206	262	302
16	287	1160	414	330	270	250	1140	499	1680	164	273	243
17	366	2050	408	325	260	250	1470	486	1380	232	238	205
18	342	1960	398	325	250	250	1790	458	1130	203	275	256
19	373	1730	408	320	220	240	1690	486	960	166	189	221
20	364	1580	423	320	265	240	1610	504	839	218	149	242
21	394	1330	437	315	230	240	1560	574	716	255	237	223
22	343	1170	441	310	233	240	1540	575	647	146	241	213
23	363	1050	442	310	235	240	1510	501	570	160	243	158
24	510	914	444	310	235	265	1510	496	518	263	240	138
25	566	835	434	310	220	320	1520	572	448	202	261	230
26	666	779	415	315	220	409	1720	695	466	191	200	200
27	667	815	418	315	230	902	1780	703	428	294	142	185
28	685	953	410	315	235	876	1700	676	394	380	237	189
29	695	899	397	310	---	1060	1550	546	378	312	198	191
30	694	844	390	305	---	979	1400	557	369	292	185	155
31	661	---	387	307	---	884	---	589	---	303	292	---
TOTAL	13064	31599	14359	10369	7405	11380	42004	20500	31415	7815	7146	7853
MEAN	421	1053	463	334	264	367	1400	661	1047	252	231	262
MAX	695	2050	714	381	307	1060	1790	1280	3030	385	295	446
MIN	287	533	368	305	220	220	792	458	369	146	142	138
CFSM	.71	1.76	.78	.56	.44	.62	2.35	1.11	1.75	.42	.39	.44
IN.	.81	1.97	.89	.65	.46	.71	2.62	1.28	1.96	.49	.45	.49

CAL YR 1988 TOTAL 167323 MEAN 457 MAX 3110 MIN 91 CFSM .77 IN 10.43
WTR YR 1989 TOTAL 204909 MEAN 561 MAX 3030 MIN 138 CFSM .94 IN 12.77

04062000 PAINT RIVER NEAR ALPHA, MI

LOCATION.--Lat 46°00'40", long 88°15'30", in NW1/4 NW1/4 sec.25, T.42 N., R.32 W., Iron County, Hydrologic Unit 04030106, on right bank 0.6 mi downstream from Lower Paint Dam, 5.5 mi upstream from Brule River, and 6.0 mi southeast of Alpha.

DRAINAGE AREA.--631 mi^2.

PERIOD OF RECORD.--June 1952 to current year. Monthly discharge only for period October 1953 to September 1960, published in WSP 1727.

REVISED RECORDS.--WSP 1727: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 1,260 ft above National Geodetic Vertical Datum of 1929, from topographic map

REMARKS.--Estimated daily discharges: Dec. 2-4, Dec. 8 to Apr. 4, and Aug. 31 to Sept. 14. Records good. Flow completely regulated by powerplant and Lower Paint Dam, 0.6 mi upstream. Records not adjusted for diversion to Michigamme River by Paint River Diversion Canal. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--37 years, 172 ft^3/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 8,050 ft^3/s, July 2, 1953, gage height, 10.50 ft; minimum daily, 62 ft^3/s, Mar. 22, 1963.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,560 ft^3/s, June 13, gage height, 5.70 ft; minimum daily, 78 ft^3/s, May 22.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	92	90	512	90	90	86	88	82	508	93	94	98
2	90	89	87	90	90	86	88	81	633	93	96	98
3	90	87	87	90	90	86	88	91	621	93	97	98
4	90	87	87	90	90	86	89	88	366	91	98	98
5	90	88	87	90	90	86	89	86	88	93	98	98
6	90	89	86	90	89	86	130	86	88	91	95	98
7	90	133	89	90	89	86	92	86	83	90	95	98
8	90	139	90	90	89	86	89	86	85	90	95	98
9	90	106	90	90	88	86	88	86	549	90	97	98
10	88	252	90	90	88	86	88	85	1150	90	98	98
11	88	398	90	90	88	86	87	85	1160	90	98	98
12	87	393	90	90	88	86	84	85	1110	90	99	98
13	90	390	90	90	87	86	92	85	1230	90	99	98
14	90	247	90	90	87	87	81	86	1400	90	98	98
15	90	88	90	90	86	87	80	86	1050	90	98	97
16	90	239	90	90	86	87	80	84	816	91	98	98
17	90	874	90	90	86	87	81	80	804	92	97	97
18	89	1260	90	90	86	87	82	80	799	93	97	96
19	89	1220	90	90	86	87	91	80	794	93	98	145
20	90	1190	90	90	86	87	88	80	462	93	97	249
21	90	881	90	90	86	87	88	79	89	93	97	248
22	88	428	90	90	86	87	88	78	90	93	97	176
23	90	88	90	90	86	87	88	91	267	93	95	90
24	90	90	90	90	86	88	87	89	417	94	95	90
25	90	86	90	90	86	88	87	94	92	95	95	90
26	90	87	90	90	86	88	88	88	92	95	95	90
27	91	434	90	90	86	88	86	88	93	95	95	90
28	91	657	90	90	86	88	83	88	93	95	95	90
29	90	649	90	90	---	88	82	88	93	94	96	89
30	90	643	90	90	---	88	82	88	93	94	98	90
31	90	---	90	90	---	88	---	168	---	94	98	---
TOTAL	2783	11502	3195	2790	2447	2692	2634	2727	15215	2861	2998	3297
MEAN	89.8	383	103	90.0	87.4	86.8	87.8	88.0	507	92.3	96.7	110
MAX	92	1260	512	90	90	88	130	168	1400	95	99	249
MIN	87	86	86	90	86	86	80	78	83	90	94	89

CAL YR 1988 TOTAL 47860 MEAN 131 MAX 1260 MIN 82
WTR YR 1989 TOTAL 55141 MEAN 151 MAX 1400 MIN 78

04062228 LAKE MICHIGAMME NEAR CHAMPION, MI

LOCATION.--Lat 46°31'39", long 88°00'15", in NE1/4 SW1/4 sec.25, T.48 N., R.30 W., Marquette County, Hydrologic Unit 04030107, on left bank 60 ft downstream from railroad bridge, at mouth of Peshekee River, 2.1 mi northwest of Champion.

DRAINAGE AREA.--193 mi².

PERIOD OF RECORD.--July 1942 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,548.83 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Aug. 8, 1962, nonrecording gage at same site and datum.

REMARKS.--Major inlets to Lake Michigamme are Peshekee River and Spurr River. The outlet is Michigamme River. Streamflow records were collected for Michigamme River (station 04062230) from October 1968 to September 1982 and for Peshekee River (station 04062200) from July 1961 to September 1978. It has been determined that the gage records river stage rather than lake stage when the lake stage falls below a gage height of about 0.10 ft. This last occurred during the 1976 and 1977 water years. Lake stage for this period was determined on the basis of stage-discharge relation at the lake outlet using discharge figures from station 04062230. Surface area of lake is 4,260 acres.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 8.49 ft, Apr. 21, 22 or 23, 1985, from floodmark; minimum, -0.50 ft, Sept. 30, Oct. 1, 1976.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 4.94 ft, Apr. 29, 30; minimum, 0.87 ft, Sept. 30.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.76	3.21	3.36	2.21	1.95	1.79	2.35	4.82	2.65	2.56	1.19	1.14
2	1.78	3.16	3.28	2.19	1.93	1.78	2.41	4.66	2.61	2.49	1.20	1.13
3	1.78	3.11	3.22	2.17	1.91	1.79	2.46	4.49	2.55	2.43	1.18	1.12
4	1.85	3.06	3.14	2.15	1.89	1.80	2.54	4.34	2.50	2.35	1.15	1.12
5	2.05	3.18	3.08	2.14	1.88	1.82	2.64	4.30	2.44	2.27	1.14	1.11
6	2.25	3.45	3.03	2.12	1.87	1.84	2.72	4.28	2.38	2.20	1.08	1.09
7	2.42	3.62	2.98	2.11	1.86	1.84	2.80	4.25	2.33	2.13	1.04	1.09
8	2.53	3.73	2.92	2.14	1.87	1.85	2.88	4.15	2.64	2.05	1.02	1.20
9	2.58	3.79	2.87	2.14	1.88	1.86	2.92	4.00	3.21	1.99	1.00	1.20
10	2.61	3.82	2.81	2.14	1.88	1.85	2.94	3.86	3.56	1.93	1.00	1.21
11	2.61	3.80	2.75	2.13	1.89	1.85	2.93	3.74	3.69	1.85	1.00	1.21
12	2.59	3.74	2.70	2.13	1.89	1.85	2.93	3.64	3.70	1.80	1.03	1.23
13	2.56	3.69	2.66	2.12	1.88	1.85	2.89	3.54	3.74	1.73	1.08	1.19
14	2.52	3.60	2.64	2.11	1.87	1.85	2.87	3.46	3.82	1.68	1.13	1.18
15	2.49	3.50	2.61	2.10	1.87	1.85	2.84	3.38	3.84	1.63	1.15	1.16
16	2.51	3.64	2.57	2.08	1.88	1.85	2.84	3.30	3.80	1.59	1.15	1.15
17	2.55	3.97	2.54	2.08	1.88	1.85	2.91	3.23	3.70	1.55	1.14	1.13
18	2.59	4.16	2.51	2.08	1.86	1.85	2.99	3.16	3.58	1.51	1.13	1.13
19	2.62	4.19	2.48	2.08	1.87	1.85	3.08	3.10	3.45	1.47	1.13	1.10
20	2.64	4.19	2.47	2.09	1.86	1.85	3.16	3.06	3.32	1.43	1.17	1.07
21	2.65	4.15	2.45	2.09	1.84	1.85	3.26	3.00	3.19	1.39	1.17	1.06
22	2.66	4.01	2.42	2.08	1.83	1.85	3.37	2.93	3.07	1.36	1.19	1.04
23	2.70	3.86	2.42	2.07	1.81	1.85	3.52	2.86	2.98	1.33	1.18	1.01
24	2.81	3.72	2.40	2.05	1.80	1.88	3.70	2.81	2.94	1.30	1.17	1.01
25	2.92	3.59	2.38	2.03	1.80	1.92	3.96	2.88	2.86	1.27	1.17	.98
26	3.04	3.48	2.35	2.03	1.81	1.97	4.29	2.89	2.80	1.26	1.16	.94
27	3.11	3.45	2.34	2.04	1.79	2.02	4.56	2.85	2.79	1.25	1.17	.95
28	3.27	3.46	2.31	2.03	1.79	2.22	4.78	2.81	2.73	1.22	1.14	.93
29	3.26	3.43	2.28	2.01	---	2.25	4.90	2.75	2.69	1.22	1.16	.89
30	3.25	3.41	2.25	1.99	---	2.28	4.92	2.71	2.63	1.21	1.12	.89
31	3.22	---	2.23	1.97	---	2.31	---	2.68	---	1.20	1.14	---
MEAN	2.59	3.64	2.66	2.09	1.86	1.91	3.25	3.48	3.07	1.70	1.13	1.09
MAX	3.27	4.19	3.36	2.21	1.95	2.31	4.92	4.82	3.84	2.56	1.20	1.23
MIN	1.78	3.06	2.23	1.97	1.79	1.78	2.35	2.68	2.33	1.20	1.00	.89

WTR YR 1989 MEAN 2.37 MAX 4.92 MIN .89

04062500 MICHIGAMME RIVER NEAR CRYSTAL FALLS, MI

LOCATION.--Lat 46°06'50", long 88°12'57", in NW1/4 sec.20, T.43 N., R.31 W., Iron County, Hydrologic Unit 04030107, on right bank 400 ft upstream from highway bridge, 5.0 mi downstream from Michigamme Reservoir, 6.0 mi east of Crystal Falls, and 15 mi upstream from confluence with Brule River.

DRAINAGE AREA.--656 mi².

PERIOD OF RECORD.--August 1944 to current year.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 1,300 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Jan. 21 and Mar. 15, 16, 21, 22. Records excellent. Flow regulated by powerplant and by Michigamme Reservoir, capacity, 119,950 acre-ft, 5 mi upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--45 years, 712 ft³/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,260 ft³/s, Apr. 28, 1960, gage height, 10.73 ft; minimum daily, 71 ft³/s, Nov. 26, 1950.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,920 ft³/s, June 10, gage height, 8.13 ft; minimum daily, 139 ft³/s, Oct. 29.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	333	161	1800	1240	868	890	870	218	1560	703	516	458
2	141	310	1790	1220	858	885	871	217	1400	692	513	214
3	292	232	1770	1220	845	877	881	218	1200	691	520	205
4	589	336	1760	1200	832	869	913	194	1010	688	527	205
5	410	718	1750	1190	817	859	991	202	692	661	526	374
6	261	927	1750	1170	865	850	1000	197	651	679	522	658
7	323	1100	1730	1170	911	844	1010	196	652	707	524	658
8	190	1090	1610	1150	897	833	1010	197	910	682	525	611
9	172	1090	1250	1060	867	820	1010	195	1930	683	524	519
10	447	1150	1220	1040	829	733	788	194	3820	730	526	517
11	584	1270	1310	972	799	509	606	428	3380	681	335	399
12	584	1770	1480	906	773	504	602	608	2620	680	192	192
13	420	2090	1470	923	804	502	601	703	2030	680	200	184
14	181	1730	1470	971	822	363	607	704	1790	491	434	182
15	182	1370	1460	961	816	301	609	706	1790	208	539	181
16	[illegible]	1410	1350	865	854	386	614	706	1780	205	425	181
17	442	1400	1180	933	883	568	389	704	1770	395	423	180
18	591	2040	1230	840	881	588	216	704	1760	563	153	180
19	590	2830	1330	545	876	500	213	403	1430	561	146	262
20	365	2670	1340	306	870	442	210	206	1620	561	188	494
21	177	1890	1330	310	865	442	211	204	1300	400	187	496
22	175	1190	1320	312	860	413	208	516	1040	165	190	496
23	186	1390	1320	684	856	385	199	628	1350	162	185	492
24	196	1840	1310	895	852	387	198	628	1540	161	185	493
25	198	1830	1300	885	847	390	206	658	1280	268	185	493
26	197	1830	1290	525	841	438	228	649	1260	439	185	492
27	203	1840	1280	296	871	566	232	644	1250	580	282	581
28	179	1840	1280	301	899	656	226	640	938	528	514	498
29	139	1820	1260	304	---	650	222	638	590	524	515	502
30	163	1810	1260	654	---	823	222	875	714	521	512	497
31	162	---	1240	883	---	943	---	1330	---	518	536	---
TOTAL	9257	42974	44240	25931	23858	19216	16163	15310	45057	16207	11734	11894
MEAN	299	1432	1427	836	852	620	539	494	1502	523	379	396
MAX	591	2830	1800	1240	911	943	1010	1330	3820	730	539	658
MIN	139	161	1180	296	773	301	198	194	590	161	146	180

CAL YR 1988 TOTAL 253372 MEAN 692 MAX 2830 MIN 111
WTR YR 1989 TOTAL 281841 MEAN 772 MAX 3820 MIN 139

04063000 MENOMINEE RIVER NEAR FLORENCE, WI

LOCATION.--Lat 45°57'04", long 88°11'13", in NE 1/4 sec.16, T.41 N., R.31 W., Michigan Meridian, Iron County, Hydrologic Unit 04030108, on left bank 0.5 mi downstream from confluence of Brule and Michigamme Rivers, 3.5 mi northeast of Florence, WI, and at mile 117.

DRAINAGE AREA.--1,780 mi^2.

PERIOD OF RECORD.--January 1914 to current year. Published as "at Twin Falls near Iron Mountain, MI" 1914-57. Records published for both sites July 1950 to September 1957.

REVISED RECORDS.--WSP 1707: 1953(M). WSP 1911: Drainage area of former site.

GAGE.--Water stage recorder. Datum of gage is 1,119.23 ft above National Geodetic Vertical Datum of 1929 (levels by Owen Ayres Associates). Prior to July 1950, headwater and tailwater gages and generation data entered hourly in daily log sheets by company employees at the Twin Falls Powerplant of Wisconsin Electric Power Co., 10.4 mi downstream.

REMARKS.--No estimated daily discharges. Records excellent. Prior to July 1950, discharge determined from powerplant records computed on basis of load-discharge rating of hydroelectric units and rating for tailwater gage during periods of spill. Rating developed by U.S. Geological Survey. Flow regulated by powerplants, by Michigamme Reservoir, capacity, 119,950 acre-ft, by Peavy Pond, capacity, 33,860 acre-ft, on Michigamme River, and by many smaller reservoirs upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--75 years, 1,813 ft^3/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 19,500 ft^3/s, Apr. 26, 1960, gage height, 14.15 ft; minimum, 38 ft^3/s, Aug. 21, 1962, Sept. 26, 1975; minimum gage height, 1.18 ft, Aug. 21, 1962, Nov. 4, 1965; minimum daily discharge, 57 ft^3/s, Sept. 26, 1975.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 7,610 ft^3/s, June 11, gage height, 8.47 ft; minimum, 134 ft^3/s, May 25, gage height, 1.63 ft; minimum daily, 535 ft^3/s, Aug. 13.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	853	1730	3210	[illegible]	[illegible]	1390	2530	1770	2630	1200	992	1100
2	865	1510	2750	[illegible]	[illegible]	1540	2600	1650	3070	1230	953	949
3	1150	1420	2400	1930	[illegible]	1440	2550	1730	2850	1300	1130	1010
4	1030	1440	2340	[illegible]	1540	1450	2590	1680	2380	1200	1040	971
5	1090	1720	2310	[illegible]	1400	1470	2730	1530	1350	1250	1510	1040
6	1080	2440	2580	1740	[illegible]	1380	2610	1530	1540	1160	1130	1250
7	909	2390	2550	[illegible]	1420	1960	2470	1520	1410	1230	1160	1250
8	945	2760	2360	[illegible]	[illegible]	[illegible]	2470	1440	1880	1310	1000	1220
9	965	2920	2150	[illegible]	1340	[illegible]	[illegible]	1160	3470	1120	1020	1000
10	1080	2780	[illegible]	[illegible]	[illegible]	[illegible]	2520	1140	6800	1060	1010	996
11	[illegible]	3140	[illegible]	[illegible]	[illegible]	[illegible]	2540	1140	7100	1170	890	925
12	946	3020	[illegible]	[illegible]	[illegible]	[illegible]	2360	1220	5950	1010	708	701
13	996	3110	[illegible]	[illegible]	[illegible]	2010	2280	1100	5370	1180	783	768
14	897	2970	[illegible]	1410	[illegible]	2180	2340	1240	4730	1140	1170	693
15	930	2820	[illegible]	1640	[illegible]	2140	2300	1170	4360	728	1360	790
16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2310	1250	4440	1030	[illegible]	802
17	914	3690	1820	[illegible]	1510	[illegible]	2140	1220	3190	903	538	760
18	890	4700	[illegible]	[illegible]	1420	[illegible]	1930	1440	3260	932	751	795
19	808	5350	1910	1340	[illegible]	[illegible]	1570	1400	3090	956	535	931
20	953	5310	[illegible]	1370	[illegible]	1480	1630	1150	2860	855	834	1020
21	850	4400	2060	[illegible]	1550	1570	1540	1570	2360	793	603	952
22	865	3160	2020	1290	1560	1310	1420	1100	2000	690	591	1060
23	864	2450	1980	1190	1470	1300	1480	1320	2250	609	611	915
24	1310	2580	1970	1240	1460	1550	1550	1240	2820	752	642	872
25	1520	2690	[illegible]	1300	1480	1170	1570	2150	2340	691	664	754
26	1640	2590	2020	1240	1450	1480	1890	2380	2230	680	610	755
27	1200	3340	2020	1240	1440	1850	1800	2090	1750	692	753	806
28	1220	3750	2000	1250	1430	2180	2090	1670	1550	868	822	764
29	1210	3480	1970	1260	---	2520	1860	1370	1390	830	858	640
30	1320	3270	2090	1340	---	2500	1870	1770	1240	953	874	668
31	1470	---	2000	1290	---	2690	---	2030	---	944	1000	---
TOTAL	32519	89940	67820	46880	40500	57130	64110	46300	90660	30466	27918	27177
MEAN	1049	2998	2188	1512	1446	1843	2137	1494	3022	983	901	906
MAX	1640	5350	3210	2020	1570	2690	2790	2380	7100	1310	1510	1250
MIN	796	1420	1810	1190	1290	1170	1420	1100	1240	609	535	640

CAL YR 1988 TOTAL 547865 MEAN 1497 MAX 5350 MIN 508
WTR YR 1989 TOTAL 621420 MEAN 1703 MAX 7100 MIN 535

04065722 MENOMINEE RIVER NEAR VULCAN, MI

LOCATION.--Lat 45°44'12", long 87°51'48", sec.34, T.39 N., R.29 W., Michigan Meridian, Dickinson County, Hydrologic Unit 04030108, on left bank 0.35 mi downstream from Sturgeon Falls Dam, 3.0 mi south of Vulcan, and at mile 78.7.

DRAINAGE AREA.--2,900 mi².

PERIOD OF RECORD.--December 1987 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 820 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Nov. 6-17 and Jan. 14-26. Records good. Flow regulated by powerplants, by Michigamme Reservoir, capacity, 119,950 acre-ft, by Peavy Pond, capacity, 33,860 acre-ft, on Michigamme River, and by smaller reservoirs upstream from station. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 8,760 ft³/s, June 10, 1989, gage height, 11.63 ft; minimum, 815 ft³/s, Aug. 3, 4, 1988, gage height, 4.67 ft; minimum daily, 846 ft³/s, Aug. 3, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 8,760 ft³/s, June 10, gage height, 11.63 ft; minimum, 897 ft³/s, Aug. 8, gage height, 4.73 ft; minimum daily, 959 ft³/s, July 26.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1230	2540	4420	2760	1700	1820	4550	2920	4160	1860	1390	1580
2	1160	2400	4330	2710	1740	1820	4400	2670	4590	1700	1400	1490
3	1400	2110	3280	2750	1850	1860	4500	2900	4840	1850	1330	1620
4	1470	2050	3300	2400	1870	1850	4530	2730	4240	1680	1490	1530
5	1450	2620	3280	2360	1880	1840	4840	2730	2920	1660	1760	1290
6	1500	4050	3570	2290	1930	1840	5350	2760	2590	1740	1560	1590
7	1450	4600	3540	2235	1740	2030	4510	2630	2350	1780	1270	1630
8	1350	4650	3230	2160	1840	2330	4870	2550	2460	1470	1260	1720
9	1280	4750	2900	2150	1870	2270	4620	2130	4520	1400	1170	1380
10	1410	4550	2860	2140	1790	2240	4430	2260	7630	1470	1230	1300
11	1470	4100	2660	2200	[illegible]	2500	[illegible]	2060	8460	1400	1190	1180
12	1290	4200	2730	2310	1840	2390	[illegible]	2050	8320	1320	1050	1030
13	1290	4300	2880	2170	1960	2520	3620	1920	6960	1350	1020	1100
14	1250	4500	2830	2100	1840	2530	3690	1880	6380	1440	1570	1040
15	1110	4450	2910	2100	1860	2530	3500	1910	6460	1140	2360	1040
16	1110	4550	2960	[illegible]	1980	2500	3550	1790	6090	1130	1710	1020
17	1260	5300	2390	2000	1860	2530	3750	1470	4880	1320	1420	1010
18	1300	6350	2410	1850	1770	2430	[illegible]	2150	5080	1310	1300	1040
19	1310	7320	2770	1900	1700	2430	3290	2150	4560	1050	1130	1160
20	1300	6890	2780	1900	1730	2180	3330	1970	4110	1200	1010	1090
21	1350	5400	2830	1800	1920	1730	3040	2040	3860	1100	986	1330
22	1320	4890	2850	1700	1760	1790	2970	2290	3050	1020	1000	1260
23	1300	4170	2860	1800	1760	1720	2910	1980	2970	1010	1010	1210
24	1740	3360	2840	1800	1710	1750	2970	2050	3860	975	1030	1160
25	2400	3650	2820	1850	1760	1960	2790	2620	3590	962	1020	976
26	2330	3820	2880	1800	1730	2090	2940	4140	3570	959	1010	1020
27	2320	4310	2870	1680	1720	2690	3350	3840	3170	979	992	984
28	2100	5310	2800	1690	1800	3780	3340	4420	2610	999	974	977
29	1960	5290	2990	1660		4850	3580	3530	2260	1130	978	970
30	1860	4620	2780	1730		5010	3250	2700	2060	1310	1000	965
31	2140		2640	1760		5010		3500		1360	1280	---
TOTAL	47210	132350	93250	64150	50650	76690	100680	77320	132620	41074	38950	36692
MEAN	1523	4412	3008	2069	1809	2474	3356	2494	4421	1325	1256	1223
MAX	2400	7320	4420	2760	1980	5010	5350	4140	8460	1860	2360	1720
MIN	1110	2050	2390	1660	1700	1700	2790	1790	2060	959	974	965

CAL YR 1988 TOTAL 776650 MEAN [illegible] MAX 7320 MIN 846
WTR YR 1989 TOTAL 903616 MEAN 2476 MAX 8460 MIN 959

04066003 MENOMINEE RIVER BELOW PEMENE CREEK NEAR PEMBINE, WI

LOCATION.--Lat 45°34'46", long 87°47'13", in NE1/4 sec.29, T.37 N., R.28 W., Michigan Meridian, Menominee County, Hydrologic Unit 04030108, on left bank 40 ft downstream from County Trunk Z bridge, 0.9 mi downstream from Pemene Creek, 3.9 mi west of Nathan, 10.6 mi southeast of Pembine, WI, and at mile 64.3.

DRAINAGE AREA.--3,140 mi².

PERIOD OF RECORD.--October 1949 to current year. Published as "near Pembine, WI" prior to August 1982. Monthly discharge only for some periods, published in WSP 1307.

GAGE.--Water-stage recorder. Elevation of gage is 740 ft above National Geodetic Vertical Datum of 1929, from topographic map. October 1949 to Oct. 27, 1972, water-stage recorder at site 1.0 mi upstream at different datum, and Oct. 28, 1972, to August 1982, water-stage recorder at site 1.5 mi upstream at different datum.

REMARKS.--Estimated daily discharges: Dec. 8 to Apr. 6. Records good except for estimated daily discharges, which are fair. Flow regulated by powerplants, by Michigamme Reservoir, capacity, 119,950 acre-ft, by Peavy Pond, capacity, 33,860 acre ft, on Michigamme River, and by many smaller reservoirs upstream from station.

AVERAGE DISCHARGE.--40 years, 2,972 ft³/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 26,900 ft³/s, May 8, 1960, gage height, 13.90 ft, site and datum then in use; minimum, 694 ft³/s, Sept. 3, 1969, gage height, 1.66 ft, site and datum then in use.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 9,660 ft³/s, June 11, gage height, 11.79 ft; maximum gage height, 16.39 ft, Dec. 31, backwater from ice; minimum daily discharge, 1,040 ft³/s, Sept. 30.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1340	2190	5070	2800	1900	1800	4700	3120	4610	1920	1400	1560
2	1210	2690	4800	2700	1800	1800	4600	2790	4970	1810	1300	1520
3	1340	2370	4730	2600	1800	1800	4700	2900	5350	1920	1340	1560
4	1450	2120	3950	2500	1800	1800	4700	2920	4500	1870	1370	1430
5	1400	2170	3280	2700	1800	1700	4800	2810	3430	1710	1830	1270
6	1430	3020	3500	2600	[illegible]	1900	[illegible]	2720	2730	1800	1550	1420
7	1430	4410	3360	2500	1900	1900	4900	2750	2540	1920	1420	1400
8	1420	4850	3200	2300	[illegible]	2100	5160	2550	2400	1650	1260	1410
9	1250	4880	2800	2300	1800	2200	4920	2230	4520	1470	1300	1550
10	1310	4580	2600	2430	1800	2200	4590	2200	7510	1550	1200	1300
11	1490	4350	2700	2400	1800	2300	3970	2190	9280	1500	1150	1270
12	1390	4450	2600	2400	1800	2400	4230	2100	8020	1390	1180	1110
13	1270	4800	2800	2300	[illegible]	2300	3670	2000	7550	1430	1100	1120
14	1270	4390	2800	2200	1900	2400	3690	1940	6670	1510	1330	1120
15	1210	4420	2400	2200	1900	2300	3740	1920	6830	1300	2470	1090
16	1140	4210	2400	2300	[illegible]	2300	3800	1950	6010	1310	1800	1140
17	1210	4880	2500	2300	1900	2400	3980	1910	5240	1290	1610	1070
18	1340	5030	2200	1950	1800	2300	3560	2070	5210	1400	1430	1090
19	1350	6490	3000	1400	1800	2300	3590	2270	4850	1250	1190	1130
20	1330	7770	3300	2000	1800	2200	3210	2140	4180	1240	1110	1130
21	1380	7210	3100	1900	1900	1800	3330	2030	4060	1200	1060	1300
22	1390	6910	3100	1700	1800	1700	3190	2340	3300	1120	1080	1300
23	1350	5240	3300	1700	1800	1700	4030	2090	3000	1110	1090	1210
24	1420	4660	3100	1800	1800	1900	3070	2110	3780	1080	1110	1280
25	2110	3650	2900	1800	1800	2300	2990	2830	3780	1060	1090	1060
26	2520	3550	2800	1900	1900	2500	3040	4130	3570	1070	1080	1050
27	2450	3880	3000	2000	1800	4000	3500	4380	3350	1120	1080	1050
28	2350	4100	2800	1900	1800	4500	3520	3680	2710	1090	1050	1050
29	2230	5440	2700	1900		5200	3730	2860	2420	1100	1050	1050
30	2170	5520	2800	1900		5200	3410	2730	2310	1280	1070	1040
31	2410		2800	2000		5200		3760		1340	1150	
TOTAL	48340	134550	96290	67800	51700	78300	118280	80900	140440	43710	40230	37730
MEAN	1559	4485	3106	2187	1846	2526	3943	2610	4681	1410	1298	1258
MAX	2520	7770	5070	2800	2000	5200	5600	4380	9280	1920	2380	1700
MIN	1130	2120	2200	1700	1800	1700	2990	1910	2310	1060	1050	1040

CAL YR 1988 TOTAL 785062 MEAN 2145 MAX 7950 MIN 952
WTR YR 1989 TOTAL 938280 MEAN 2571 MAX 9280 MIN 1040

04067500 MENOMINEE RIVER NEAR McALLISTER, WI

LOCATION.--Lat 45°19'33", long 87°39'48", in SW1/4 SE1/4 sec.17, T.33 N., R.23 E., Marinette County, WI, Hydrologic Unit 04030108, on right bank 85 ft downstream from bridge on County Highway JJ, 2.9 mi downstream from Grand Rapids Dam, 2.6 mi east of McAllister, WI, 1.9 mi downstream from Little Cedar River, and at mile 22.6.

DRAINAGE AREA.--3,930 mi².

PERIOD OF RECORD.--March 1945 to September 1961, October 1961 to September 1979 (miscellaneous measurements and annual maximums only), October 1979 to September 1986, October 1986 to March 1987 (crest-stage partial-record station), April 1988 to current year.

REVISED RECORDS.--WDR WI-80-1: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 622.20 ft above National Geodetic Vertical Datum of 1929 (Michigan Department of Transportation reference mark). Prior to May 15, 1945, nonrecording gage 1,400 ft downstream at same datum; May 16, 1945, to September 1961, water-stage recorder 1,000 ft downstream at same datum; October 1961 to September 1979, crest-stage gage 1,100 ft downstream at same datum. October 1979 to September 1986, water-stage recorder at same site and datum; October 1986 to March 1987, crest-stage gage at same site and datum.

REMARKS.--Estimated daily discharges: Oct. 11-13, 26-31, Nov. 11, 12, 14, 16-24, 28-30, Dec. 1-5, and Dec. 11 to Apr. 5. Records good except for estimated daily discharges, which are fair. Flow regulated by powerplants, by Michigamme Reservoir, capacity. 119,950 acre-ft, by Peavy Pond, capacity, 33,860 acre-ft, on the Michigamme River, and by many smaller reservoirs upstream from station. Gage-height telemeter at station.

AVERAGE DISCHARGE.--24 years (water years 1946-61, 1980-86, 1989), 3,551 ft³/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 32,500 ft³/s, May 9, 1960, gage height, 20.0 ft, from graph based on gage readings; minimum observed, 538 ft³/s, Oct. 6, 1946, gage height, 7.29 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 9,850 ft³/s, June 12, gage height, 13.74 ft; maximum gage height, 14.94 ft, Mar. 31, backwater from ice; minimum daily discharge, 1,070 ft³/s, Sept. 29, 30.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1640	2880	5000	2700	2000	1900	8800	3870	5730	2490	1790	1460
2	1460	2500	5200	2800	2000	1900	7000	3730	6170	2160	1730	1800
3	1440	2780	4500	2700	1900	1900	6800	3680	6400	2120	1630	1660
4	1520	2550	4000	2700	1800	1900	7200	3400	6530	2210	1510	1650
5	1740	2890	3400	2500	1900	1900	7400	3650	5010	2030	1420	1810
6	1610	3490	4520	2800	1900	1800	7530	3450	3730	1860	1930	1580
7	1620	3900	4170	2600	1900	1900	8060	3430	3340	2050	1720	1610
8	1620	4990	3900	2500	1900	1900	6800	3420	3220	2020	1640	1790
9	1750	5240	3400	2400	1800	2200	6790	3100	4340	1950	1350	1810
10	1390	5170	2970	2000	1800	2300	6440	2900	6040	1450	1410	1890
11	1500	4500	2700	2300	1600	2300	5930	2870	8440	1590	1310	1300
12	1600	4700	3000	2200	1800	2400	5170	2670	9490	1730	1320	1430
13	1600	5070	2900	2200	1900	2500	4960	2470	9380	1460	1440	1300
14	1340	4900	2900	2200	2000	2400	4550	2560	8390	1430	1420	1100
15	1480	4870	3000	2200	1900	2500	4640	2450	7510	1770	1700	1340
16	1350	5000	2700	2200	2000	2400	4930	2270	7750	1460	2740	1180
17	1180	6000	2600	2200	2000	2400	4970	2450	7480	1340	1950	1150
18	1540	6600	2800	2200	1900	2500	5100	2400	6360	1370	1710	1250
19	1650	7200	2200	2100	1900	2400	4920	2510	5890	1640	1600	1090
20	1570	8000	3000	2000	1800	2300	4880	2590	5720	1550	1520	1240
21	1510	8000	3500	1900	1900	2200	3940	2800	4530	1370	1220	1410
22	1680	7000	3200	2000	1900	1800	4080	2430	4540	1320	1240	1350
23	1600	5400	3200	1500	1800	1800	4100	2660	3790	1340	1210	1300
24	1870	4900	3300	1800	1800	1800	3920	2450	3840	1240	1150	1240
25	2240	4090	3200	1800	1800	2000	3810	2930	4290	1150	1200	1270
26	2500	4120	3000	1900	1800	2300	3790	4210	4420	1130	1370	1270
27	2500	5110	2900	2000	2000	2800	3840	5170	4050	1340	1180	1210
28	2400	4500	3100	2000	1900	4000	4280	5160	3650	1430	1210	1080
29	2200	6000	3100	1800	---	5400	4070	4030	2700	1330	1270	1070
30	2200	6600	2800	2000	---	6400	4100	3340	2670	1240	1130	1070
31	2400	---	3000	1900	---	8000	---	3840	---	1550	1150	---
TOTAL	53700	148950	103160	68100	52800	82200	162800	99090	165400	50170	46170	41710
MEAN	1732	4965	3328	2197	1886	2652	5427	3196	5513	1618	1489	1390
MAX	2500	8000	5200	2800	2000	8000	8800	5170	9490	2490	2740	1890
MIN	1180	2500	2200	1500	1800	1800	3790	2270	2670	1130	1130	1070

WTR YR 1989 TOTAL 1074250 MEAN 2943 MAX 9490 MIN 1070

04096400 ST. JOSEPH RIVER NEAR BURLINGTON, MI

LOCATION.--Lat 42°06'10", long 85°02'25", in SW1/4 SW1/4 sec.20, T.4 S., R.6 W., Calhoun County, Hydrologic Unit 04050001, on right bank 10 ft upstream from former bridge on 13 Mile Road, 2.0 mi east of Burlington, 4.0 mi downstream from Tekonsha Creek, and at mile 164.

DRAINAGE AREA.--201 mi².

PERIOD OF RECORD.--October 1962 to current year.

GAGE.--Water-stage recorder. Datum of gage is 916.21 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 11-17, Jan. 3, 4, 14-16, Feb. 6 to Mar. 6, and June 7 to Aug. 30. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--27 years, 175 ft³/s, 11.82 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,390 ft³/s, June 5, 1989, gage height, 5.82 ft; minimum, 8.0 ft³/s, Aug. 9, 10, 11, 1964.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,390 ft³/s, June 5, gage height, 5.82 ft; minimum, 59 ft³/s, Oct. 16, gage height, 1.93 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	97	129	339	246	269	135	338	191	1330	230	145	243
2	88	125	331	261	264	130	312	188	1270	215	140	375
3	91	123	324	230	254	135	363	189	1190	200	140	338
4	87	124	314	210	240	140	444	185	1320	190	150	287
5	85	141	302	202	226	150	468	182	1330	175	160	235
6	80	169	292	209	205	170	438	177	1210	160	170	204
7	76	198	279	228	200	157	423	173	1080	150	160	236
8	72	219	264	321	195	171	414	169	980	140	150	246
9	71	228	253	314	190	191	408	167	890	135	140	235
10	68	328	243	265	185	177	398	163	800	150	130	212
11	68	376	210	262	180	183	380	161	740	160	120	190
12	66	353	195	302	175	201	353	158	670	140	110	172
13	63	364	190	304	175	203	322	169	610	155	105	163
14	62	363	195	295	170	212	296	175	550	150	105	170
15	60	347	210	285	170	263	281	177	500	140	100	180
16	62	386	200	270	170	260	264	173	450	130	99	180
17	87	417	195	251	165	251	258	169	410	125	98	180
18	173	403	187	237	160	274	253	163	375	125	98	171
19	201	410	184	242	155	299	247	167	355	130	98	160
20	196	419	215	231	155	297	242	177	340	130	110	149
21	192	508	214	[illegible]	150	279	238	175	320	140	135	141
22	186	513	203	257	145	288	232	179	310	155	120	135
23	179	484	232	217	140	276	225	177	300	170	110	128
24	178	455	245	205	140	262	217	172	295	180	110	123
25	176	429	245	204	150	253	221	179	290	150	110	118
26	174	408	238	212	145	244	219	169	280	175	110	114
27	165	402	241	219	145	238	217	187	270	170	115	109
28	156	388	269	215	140	239	213	184	260	165	120	105
29	148	367	267	222		296	204	176	255	160	130	102
30	140	348	242	251		304	198	204	245	155	145	98
31	135		233	254		307	---	839	---	150	126	---
TOTAL	3658	9931	7564	7596	5063	7024	9058	6138	19215	4930	3859	5499
MEAN	118	331	244	245	181	227	302	198	641	159	124	183
MAX	201	513	339	321	269	307	468	839	1330	230	170	375
MIN	60	123	184	202	140	130	198	158	245	125	98	98
CFSM	.59	1.65	1.21	1.22	.90	1.13	1.50	.99	3.19	.79	.62	.91
IN.	.68	1.84	1.40	1.40	.94	1.30	1.68	1.14	3.56	.91	.71	1.02

CAL YR 1988 TOTAL 60980 MEAN 167 MAX 513 MIN 13 CFSM .83 IN 11.29
WTR YR 1989 TOTAL 89537 MEAN 245 MAX 1330 MIN 60 CFSM 1.22 IN 16.57

04096515 SOUTH BRANCH HOG CREEK NEAR ALLEN, MI

LOCATION.--Lat 41°56'55", long 84°49'40", in NE1/4 SE1/4 sec.13, T.6 S., R.5 W., Branch County, Hydrologic Unit 04050001, on left bank 12 ft downstream from bridge on U.S. Highway 12, 1.0 mi downstream from Little Hog Creek, and 3.1 mi west of Allen.

DRAINAGE AREA.--48.7 mi^2.

PERIOD OF RECORD.--October 1969 to current year. Prior to October 1987, published as Hog Creek near Allen.

GAGE.--Water stage recorder. Elevation of gage is 1,010 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to May 13, 1970, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 10-19, Dec. 26 to Jan. 16, Jan. 21, 22, and Feb. 3 to Mar. 8. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--20 years, 42.7 ft^3/s, 11.91 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 664 ft^3/s, Feb. 25, 1985, gage height, 6.0 ft, from floodmark; maximum gage height, 6.20 ft, June 1, 1989; minimum discharge, 0.48 ft^3/s, Aug. 5, 1988; minimum gage height, 1.20 ft, July 16, Aug. 5, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 646 ft^3/s, June 1, gage height, 6.20 ft; minimum, 3.1 ft^3/s, Oct. 14, 15, 16, gage height, 1.31 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.0	12	85	60	74	22	97	41	599	33	31	25
2	6.2	12	79	54	71	22	88	40	576	30	27	42
3	7.6	11	73	52	65	23	94	43	466	34	24	43
4	6.3	12	68	50	55	23	116	41	388	36	23	35
5	5.6	19	63	47	49	30	139	39	325	34	29	29
6	4.9	27	59	45	45	40	142	37	270	31	37	25
7	4.4	32	56	44	43	52	129	35	222	28	38	29
8	4.1	38	52	70	41	40	115	33	183	26	34	39
9	3.9	41	48	85	39	35	102	32	152	27	29	40
10	4.2	54	44	100	38	35	92	32	125	31	26	36
11	3.8	64	41	85	36	40	83	29	107	29	23	32
12	3.5	69	38	75	35	46	75	28	94	41	21	27
13	3.5	72	37	65	33	44	70	37	87	51	21	24
14	3.3	73	36	60	32	45	64	39	83	48	21	25
15	3.1	71	35	55	31	59	60	37	78	44	21	29
16	3.3	85	35	52	30	63	56	36	71	38	21	30
17	7.4	115	35	51	29	56	53	33	65	32	19	30
18	24	131	36	48	28	74	56	30	58	28	18	27
19	30	127	36	47	27	93	55	32	53	26	16	24
20	25	121	38	51	26	95	52	44	78	29	16	22
21	22	121	39	47	25	87	50	44	116	33	17	20
22	20	122	36	44	25	76	46	39	111	41	17	19
23	19	117	51	43	25	72	44	35	93	49	16	18
24	22	108	62	40	24	68	41	32	78	43	16	16
25	21	97	63	40	24	67	47	41	66	36	14	14
26	20	89	60	46	23	66	60	55	56	33	13	14
27	18	88	56	52	22	65	57	51	50	35	12	12
28	16	91	62	51	22	68	53	44	48	38	12	12
29	15	93	70	55		91	49	39	43	37	17	11
30	14	90	80	65		106	45	44	37	34	18	11
31	13		70	70		106		248		33	17	---
TOTAL	358.1	2202	1643	1749	1017	1809	2230	1390	4778	1088	664	760
MEAN	11.6	73.4	53.0	56.4	36.3	58.4	74.3	44.8	159	35.1	21.4	25.3
MAX	30	131	85	100	74	106	142	248	599	51	38	43
MIN	3.1	11	35	40	22	22	41	28	37	26	12	11
CFSM	.24	1.51	1.09	1.16	.75	1.20	1.53	.92	3.27	.72	.44	.52
IN.	.27	1.68	1.25	1.34	.78	1.38	1.70	1.06	3.65	.83	.51	.58

CAL YR 1988 TOTAL 11902.09 MEAN 32.5 MAX 173 MIN .58 CFSM .67 IN 9.09
WTR YR 1989 TOTAL 19688.10 MEAN 53.9 MAX 599 MIN 3.1 CFSM 1.11 IN 15.04

04096600 COLDWATER RIVER NEAR HODUNK, MI

LOCATION.--Lat 42°01'45", long 85°06'25", in NW1/4 NE1/4 sec.22, T.5 S., R.7 W., Branch County, Hydrologic Unit 04050001, on right bank at downstream side of bridge on Girard Road, 2.5 mi northwest of Hodunk, and 3.5 mi upstream from mouth.

DRAINAGE AREA.--293 mi².

PERIOD OF RECORD.--October 1962 to current year (discontinued).

REVISED RECORDS.--WDR MI-76-1: 1974.

GAGE.--Water-stage recorder. Elevation of gage is 900 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to July 26, 1963, nonrecording gage and crest stage gage at same site and datum.

REMARKS.--Estimated daily discharges: Feb. 7-11 and 18-23. Records good. Diurnal fluctuation caused by mills upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--27 years, 256 ft³/s, 11.87 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,800 ft³/s, June 2, 1989, gage height, 9.17 ft; minimum, 6.2 ft³/s, Sept. 26, 1964; minimum gage height, 2.28 ft, Oct. 4-14, 1964.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,800 ft³/s, June 2, gage height, 9.17 ft; minimum, 22 ft³/s, Oct. 13; minimum gage height, 2.59 ft, Oct. 8, 9, 11, 12, 13.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	28	182	528	449	382	200	507	231	2540	255	207	217
2	30	169	504	417	381	190	466	138	2780	244	195	412
3	32	161	478	377	356	201	505	136	2660	227	186	347
4	29	158	451	333	321	208	649	137	2410	204	184	290
5	29	164	429	284	310	238	716	138	2100	202	192	185
6	28	181	410	304	302	237	738	148	1830	197	189	136
7	26	193	391	308	290	214	779	141	1640	191	170	171
8	25	202	372	414	280	237	815	147	1480	185	106	190
9	25	215	355	417	275	237	756	154	1350	223	107	267
10	24	311	340	503	270	231	695	158	1230	264	108	248
11	24	357	318	486	265	235	640	157	1180	225	109	231
12	23	368	297	557	262	250	593	159	1080	182	114	215
13	22	371	311	617	259	253	544	177	1000	197	116	205
14	23	379	305	535	257	257	454	190	927	203	117	207
15	23	376	297	491	259	297	363	194	873	200	118	209
16	25	416	280	491	254	301	341	195	806	192	157	182
17	40	494	272	454	243	290	328	197	731	186	187	159
18	99	625	279	427	236	324	329	268	656	173	177	157
19	118	617	278	413	230	352	335	338	544	164	171	155
20	118	655	290	404	225	358	332	330	671	183	172	155
21	112	744	305	384	220	364	330	317	704	220	177	155
22	144	748	309	358	215	355	327	304	487	235	171	156
23	203	709	355	363	215	339	320	269	501	225	168	149
24	198	655	413	345	213	327	313	169	501	212	152	149
25	197	608	417	336	222	320	314	189	455	209	78	144
26	195	592	401	320	218	320	318	230	424	201	73	137
27	192	627	401	295	212	320	314	238	405	190	70	137
28	198	601	448	297	205	329	303	233	384	185	77	134
29	219	577	467	310	---	446	290	221	352	180	101	131
30	204	548	463	344		579	278	239	270	180	105	140
31	193		441	371		567	-	1360		190	107	---
TOTAL	2846	13003	11605	12404	7377	9376	13992	7492	32971	6324	4361	5822
MEAN	91.8	433	374	400	263	302	466	242	1099	204	141	194
MAX	219	748	528	617	382	579	815	1360	2780	264	207	412
MIN	22	158	272	284	205	190	278	136	270	164	70	131
CFSM	.31	1.48	1.28	1.37	.90	1.03	1.59	.83	3.75	.70	.48	.66
IN.	.36	1.65	1.47	1.57	.94	1.19	1.78	.95	4.19	.80	.55	.74

CAL YR 1988 TOTAL 81999 MEAN 224 MAX 1020 MIN 14 CFSM .77 IN 10.41
WTR YR 1989 TOTAL 127573 MEAN 350 MAX 2780 MIN 22 CFSM 1.20 IN 16.20

04096900 NOTTAWA CREEK NEAR ATHENS, MI

LOCATION.--Lat 42°03'20", long 85°18'30", in NW1/4 sec.12, T.5 S., R.9 W., St. Joseph County, Hydrologic Unit 04050001, on right bank at downstream side of bridge on Shorts Road, 4.2 mi southwest of Athens, and 5.0 mi downstream from Pine Creek.

DRAINAGE AREA.--162 mi².

PERIOD OF RECORD.--October 1966 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 850 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 12-18, 30, 31, Jan. 4, 5, and Feb. 6 to Mar. 3. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--23 years, 151 ft³/s, 12.66 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,190 ft³/s, June 2, 1989, gage height, 7.85 ft; minimum, 21 ft³/s, July 28, 29, 30, Aug. 4, 6, 1977, Aug. 4, 1988; minimum gage height, 0.37 ft, Oct. 16, 18, 20, 21, Nov. 8, 1971.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,190 ft³/s, June 2, gage height, 7.85 ft; minimum daily, 67 ft³/s, Oct. 14, 15.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	90	131	265	234	258	110	245	131	1860	156	129	127
2	94	126	249	216	249	105	225	129	2170	148	123	158
3	106	122	239	195	219	110	235	133	1990	142	117	159
4	113	122	230	185	187	121	284	134	1700	137	120	151
5	109	127	223	175	165	145	324	131	1420	133	136	145
6	99	145	217	170	160	160	326	127	1170	128	147	136
7	89	172	213	169	155	183	303	122	963	122	143	136
8	81	192	206	245	150	161	273	120	784	117	138	140
9	78	206	199	299	150	132	243	119	643	119	134	140
10	75	273	190	360	145	136	220	118	532	119	128	132
11	74	371	175	307	145	153	204	114	446	115	122	124
12	71	422	170	257	140	185	193	112	385	116	115	118
13	68	431	160	240	140	201	184	119	360	117	113	115
14	67	422	160	220	135	206	177	126	358	114	110	119
15	67	396	155	198	135	252	174	126	363	109	107	123
16	72	368	155	189	130	295	170	123	357	105	102	123
17	105	357	155	184	130	303	167	120	336	104	99	121
18	156	347	150	181	125	341	163	116	309	100	95	118
19	190	330	151	183	125	387	165	121	282	98	91	114
20	201	327	155	190	125	384	156	145	267	113	93	109
21	202	356	180	181	120	358	151	156	257	139	94	104
22	194	387	193	174	120	320	147	155	245	153	93	101
23	184	388	221	171	120	282	143	145	232	177	93	95
24	180	370	255	172	120	249	139	132	214	179	91	92
25	186	343	264	170	120	231	142	137	199	167	89	90
26	191	318	245	182	115	223	152	160	188	153	88	89
27	186	300	228	198	115	219	153	166	188	152	87	86
28	176	295	260	197	110	223	146	163	187	147	88	84
29	165	288	294	201		253	141	153	176	138	91	83
30	151	276	280	224		270	136	158	165	135	91	81
31	139		250	245		264	---	752	---	134	88	
TOTAL	3957	8708	6491	6514	4108	6962	5876	4765	18746	4086	3355	3513
MEAN	128	290	209	210	147	225	196	154	625	132	108	117
MAX	202	431	294	360	258	387	326	752	2170	179	147	159
MIN	67	122	150	169	110	105	136	112	165	98	87	81
CFSM	.79	1.79	1.29	1.30	.91	1.39	1.21	.95	3.86	.82	.67	.72
IN.	.91	2.00	1.49	1.50	.94	1.60	1.35	1.09	4.30	.94	.77	.81

CAL YR 1988 TOTAL 563[illegible] MEAN 154 MAX 584 MIN 21 CFSM .95 IN 12.95
WTR YR 1989 TOTAL 77083 MEAN 211 MAX 2170 MIN 67 CFSM 1.30 IN 17.70

04097195 GOURDNECK CANAL NEAR SCHOOLCRAFT, MI

LOCATION.--Lat 42°09'54", long 85°36'15", in NW1/4 sec.33, T.4 S., R.11 W., Kalamazoo County, Hydrologic Unit 04050001, on right bank at downstream end of culvert on Osterhout Avenue, 3.8 mi northeast of Schoolcraft.

DRAINAGE AREA.--Indeterminate.

PERIOD OF RECORD.--October 1965 to December 1972, October 1982 to current year.

GAGE.--Water-stage recorder. Metal V-notch weir Aug. 4, 1969, to Dec. 31, 1972. Datum of gage is 854.98 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources).

REMARKS.--Estimated daily discharges: Sept. [illegible]. Records [illegible]. Canal diverts water from Gourdneck Creek to West Lake to sustain lake levels. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 16 ft³/s, Dec. 10-12, 1966, Apr. 22-24, 1967; no flow on many days during November, December, 1970, January, February, 1971.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.9	[illegible]	3.4	[illegible]	[illegible]	2.4	[illegible]	2.4	[illegible]	2.5	1.9	2.1
2	2.0	[illegible]	3.3	3.6	[illegible]	2.1	[illegible]	2.4	[illegible]	2.5	1.9	2.2
3	[illegible]	2.1	3.3	[illegible]	2.9	[illegible]	[illegible]	2.4	[illegible]	2.4	1.8	2.2
4	[illegible]	2.2	3.3	[illegible]	2.8	[illegible]	[illegible]	[illegible]	2.5	2.4	1.9	2.1
5	2.0	2.4	3.3	3.5	2.8	[illegible]	[illegible]	[illegible]	2.5	2.3	2.1	2.1
6	[illegible]	[illegible]	3.3	3.5	[illegible]	[illegible]	[illegible]	2.3	[illegible]	[illegible]	1.9	2.1
7	[illegible]	2.8	3.2	3.5	2.9	[illegible]	[illegible]	[illegible]	2.8	2.2	1.9	2.1
8	1.9	2.8	3.2	[illegible]	2.8	[illegible]	[illegible]	[illegible]	[illegible]	2.2	1.8	2.1
9	1.8	[illegible]	3.2	[illegible]	2.8	3.1	[illegible]	[illegible]	2.9	2.2	1.8	2.1
10	1.8	[illegible]	3.2	3.5	[illegible]	[illegible]	[illegible]	[illegible]	2.9	[illegible]	[illegible]	2.1
11	1.8	[illegible]	3.2	3.4	[illegible]	[illegible]	[illegible]	[illegible]	2.8	[illegible]	[illegible]	2.1
12	1.8	[illegible]	3.2	3.4	[illegible]	[illegible]	[illegible]	[illegible]	2.8	2.1	[illegible]	2.1
13	1.8	[illegible]	3.2	3.4	[illegible]	[illegible]	3.1	[illegible]	[illegible]	[illegible]	1.8	[illegible]
14	1.7	3.1	3.2	3.4	[illegible]	[illegible]	3.1	[illegible]	2.9	[illegible]	1.7	2.1
15	1.7	3.0	3.2	3.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.9	1.8	2.1
16	[illegible]	3.3	3.2	3.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.9	1.8	2.1
17	[illegible]	3.3	3.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.9	1.8	2.1
18	2.1	3.3	3.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.8	1.7	2.1
19	[illegible]	3.3	3.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.7	2.0
20	[illegible]	3.5	3.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.9	1.8	2.0
21	2.2	[illegible]	3.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.7	1.9	1.8	2.0
22	2.2	[illegible]	3.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.7	2.0	1.9	2.0
23	[illegible]	3.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.6	2.0	1.9	2.0
24	[illegible]	3.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.7	2.0	1.9	1.9
25	2.3	3.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.6	2.1	1.8	1.9
26	[illegible]	3.4	3.5	[illegible]	[illegible]	[illegible]	4.0	2.1	2.6	2.0	1.8	1.9
27	2.1	[illegible]	[illegible]	[illegible]	[illegible]	2.8	[illegible]	[illegible]	2.9	2.0	1.9	1.9
28	2.1	[illegible]	[illegible]	[illegible]	[illegible]	3.0	[illegible]	1.9	2.8	2.0	1.8	1.8
29	[illegible]	3.4	3.8	[illegible]		3.2	[illegible]	1.9	2.6	2.0	1.9	1.7
30	2.1	3.4	3.8	[illegible]		[illegible]	2.4	[illegible]	2.5	2.0	2.0	1.7
31	[illegible]		[illegible]	[illegible]		3.1		[illegible]		1.9	2.0	
TOTAL	61.4	[illegible]	[illegible]	[illegible]	[illegible]	84.3	[illegible]	[illegible]	81.4	64.6	57.1	61.0
MEAN	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.72	[illegible]	[illegible]	2.71	2.08	1.84	2.03
MAX	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.0	2.5	2.1	2.3
MIN	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.9	2.4	1.8	1.7	1.7

CAL YR [illegible] TOTAL [illegible] MEAN [illegible] MAX [illegible] MIN [illegible]
WTR YR [illegible] TOTAL [illegible] MEAN [illegible] MAX [illegible] MIN [illegible]

04097540 PRAIRIE RIVER NEAR NOTTAWA, MI

LOCATION.--Lat 41°53'18", long 85°24'34", in NW1/4 SW1/4 sec.6, T.7 S., R.9 W., St. Joseph County, Hydrologic Unit 04050001, on left bank 10 ft upstream from bridge on State Highway 66, 3.0 mi upstream from unnamed tributary, and 3.0 mi southeast of Nottawa.

DRAINAGE AREA.--106 mi^2.

PERIOD OF RECORD.--October 1962 to current year.

GAGE.--Water stage recorder. Elevation of gage is 850 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 12, 29, 30, Jan. 4-9, and Feb. 6 to Mar. 8. Records good except for estimated daily discharges, which are fair. Since 1987, some diversion by pumping for sprinkler irrigation. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--27 years, 94.5 ft^3/s, 12.11 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 747 ft^3/s, Feb. 26, 1985, gage height, 6.30 ft; minimum, 5.4 ft^3/s, Aug. 4, 5, 1988, gage height, 1.57 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 569 ft^3/s, June 4, gage height, 5.74 ft; minimum, 29 ft^3/s, Oct. 15, 16; minimum gage height, 2.56 ft, Oct. 1.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	[illegible]	59	134	117	114	69	143	84	396	110	50	67
2	40	57	130	111	115	68	139	88	502	104	48	77
3	43	56	125	107	111	68	147	90	545	96	44	81
4	43	55	122	100	106	72	167	88	563	93	45	76
5	41	57	119	99	102	80	176	84	517	86	49	70
6	39	61	116	100	97	87	181	83	449	81	[illegible]	67
7	36	66	113	104	94	85	178	80	385	78	[illegible]	72
8	35	70	111	123	92	83	170	77	324	74	[illegible]	76
9	35	74	108	140	91	81	162	76	275	76	46	83
10	35	98	105	144	90	80	151	72	241	74	45	82
11	35	117	102	148	88	82	142	71	216	71	41	78
12	34	131	98	144	87	86	134	71	201	70	40	73
13	32	136	94	130	86	88	128	74	196	70	43	70
14	31	132	96	128	85	89	122	72	188	68	42	71
15	29	130	95	121	84	96	117	71	181	65	41	72
16	[illegible]	132	93	115	83	100	113	69	172	61	41	73
17	46	135	90	110	81	99	111	67	163	57	43	71
18	78	142	90	108	79	104	112	66	155	53	44	68
19	94	154	89	107	78	110	110	74	152	56	44	63
20	99	163	92	107	77	116	109	84	168	60	49	58
21	94	170	93	106	76	117	106	88	215	61	52	54
22	67	173	94	103	76	114	103	85	216	63	56	51
23	84	171	107	103	75	111	99	80	197	61	58	50
24	83	164	115	98	74	109	98	76	179	60	57	48
25	81	158	119	97	73	107	95	81	162	61	54	46
26	78	152	117	99	72	105	100	85	148	59	51	47
27	75	149	123	100	71	105	97	87	141	55	48	47
28	73	145	129	100	70	108	96	85	136	53	49	46
29	68	142	130	103		127	92	82	127	50	55	46
30	64	138	125	107		139	87	82	119	50	56	44
31	62		124	111		144		156		51	56	
TOTAL	1739	3589	3406	3499	2425	3028	3787	2528	7629	2129	1500	1927
MEAN	56.1	120	110	113	86.6	97.7	126	81.5	254	68.7	48.4	64.2
MAX	99	173	134	148	115	144	181	156	563	110	58	83
MIN	29	55	89	97	70	68	87	66	119	50	40	44
CFSM	.53	1.13	1.04	1.07	.82	.92	1.19	.77	2.40	.65	.46	.61
IN.	.61	1.26	1.19	1.23	.85	1.06	1.33	.89	2.68	.75	.53	.68

CAL YR 1988 TOTAL 28045.9 MEAN 76.6 MAX 197 MIN 5.4 CFSM .72 IN 9.84
WTR YR 1989 TOTAL 37179.0 MEAN 102 MAX 563 MIN 29 CFSM .96 IN 13.05

04099000 ST. JOSEPH RIVER AT MOTTVILLE, MI

LOCATION.--Lat 41°48'03", long 85°45'22", in SW1/4 sec.6, T.8 S., R.12 W., Michigan Meridian, St. Joseph County, Hydrologic Unit 04050001, on right bank 500 ft upstream from bridge on U.S. Highway 12 in Mottville, 0.4 mi downstream from Indiana Michigan Power Co. hydroelectric plant, 4 mi upstream from Pigeon River, and at mile 96.

DRAINAGE AREA.--1,866 mi².

PERIOD OF RECORD.--October 1923 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1387: 1930, 1932, 1938, 1940-42, 1945. WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 755.3 ft, Indiana Michigan Power Co. datum. Prior to Oct. 1, 1951, at site 0.4 mi upstream at datum 4.2 ft higher.

REMARKS.--No estimated daily discharges. Records good. Flow regulated by powerplants upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--66 years, 1,608 ft³/s, 11.70 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 11,400 ft³/s, June 4, 1989, gage height, 10.41 ft; maximum gage height, 10.76 ft, Apr. 27, 1950, present datum; minimum daily discharge, 39 ft³/s, Oct. 19, 1963.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 11,400 ft³/s, June 4, gage height, 10.41 ft; minimum daily, 753 ft³/s, Oct. 16.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	910	1570	3030	2600	2420	1510	2970	1890	5020	2120	1210	1240
2	1070	1530	2980	2600	2500	1510	2970	1880	8410	2050	1330	1800
3	1070	1520	2880	2320	2430	1520	2990	1880	10100	1910	1190	1860
4	1090	1430	2670	2240	2310	1560	3190	1810	10700	1810	1350	1880
5	1100	1400	2660	2220	2210	1690	3320	1770	10700	1630	1420	1940
6	1040	1440	2470	2360	2110	1540	3560	1720	9450	1510	1590	1970
7	820	1620	2420	2330	1820	937	3800	1450	8510	1430	1520	1850
8	1020	1760	2500	2350	1800	1830	3590	1550	7560	1280	1410	1680
9	869	1820	2380	2410	1860	1950	3350	1600	7030	1240	1160	1750
10	755	2290	2290	2430	1770	1710	3220	1590	6080	1380	1290	1750
11	882	2720	2180	2790	1690	1670	3230	1610	5470	1520	1020	1430
12	903	2890	1860	3030	1850	1810	3040	1600	4990	1300	1030	1740
13	854	3450	1990	2930	2060	1880	2670	1460	4770	1470	821	1510
14	823	3470	2050	2800	1870	1930	2670	1190	4410	1440	866	1700
15	798	2990	2140	2830	1860	2110	2810	1470	4000	1200	1080	1610
16	753	3250	1880	2610	1940	2430	2620	1640	3960	892	868	1550
17	786	3210	1810	2610	1780	2450	2360	1400	3740	1550	1040	1570
18	1920	3690	1830	2500	1680	2660	2410	1520	3390	1020	851	1680
19	1790	3010	1800	2460	1730	2720	2280	1560	3200	1200	898	1520
20	1660	3030	1980	2430	1710	2820	2220	1590	3130	1210	913	1440
21	1830	3240	2020	2380	1750	2870	2220	1650	2990	1210	1360	1550
22	1880	3350	1960	2130	1700	2730	2180	1790	2590	1550	1120	1130
23	1940	3400	2140	2280	1670	2680	2000	1820	2800	1520	1140	866
24	1920	3510	2460	2200	1660	2620	2120	1740	2810	1730	1200	1210
25	1880	3380	2170	2190	1620	2450	2010	1650	2550	1630	1160	1350
26	1860	3080	2470	2230	1570	2450	2090	1770	2700	1670	1160	1390
27	1910	3230	2510	2140	1560	2370	2020	1780	2400	1560	1050	1210
28	1820	3220	2550	2220	1600	2370	2090	1610	2290	1560	829	1050
29	1740	3150	2580	2250		2660	2080	1670	2510	1520	1050	976
30	1730	2930	2630	2280		2830	1920	1560	2350	1470	1070	985
31	1690	---	2530	2200		2750	---	2190	---	1390	966	---
TOTAL	41113	79980	71820	75350	52530	67017	80000	51410	150110	45972	34962	45187
MEAN	1326	2666	2317	2431	1876	2162	2667	1658	5004	1483	1128	1506
MAX	1940	3510	3030	3030	2500	2870	3800	2190	10700	2120	1590	1970
MIN	753	1400	1800	2130	1560	937	1920	1190	2290	892	821	866
CFSM	.71	1.43	1.24	1.30	1.01	1.16	1.43	.89	2.68	.80	.61	.81
IN.	.82	1.59	1.43	1.50	1.05	1.34	1.59	1.02	2.99	.92	.70	.90

CAL YR 1988 TOTAL 591150 MEAN 1615 MAX 4160 MIN 222 CFSM .87 IN 11.78
WTR YR 1989 TOTAL 795451 MEAN 2179 MAX 10700 MIN 753 CFSM 1.17 IN 15.86

04099750 PIGEON RIVER NEAR SCOTT, IN

LOCATION.--Lat 41°44'56", long 85°34'35", in SE1/4 NW1/4 sec.14, T.38 N., R.8 E., Lagrange County, Hydrologic Unit 04050001, on right bank 20 ft downstream from bridge on County Road 750 North, 1,200 ft downstream from Page Ditch, 0.7 mi south of Indiana-Michigan State line, and 1.2 mi northwest of Scott, IN.

DRAINAGE AREA.--361 mi^2, of which 53.9 mi^2 does not contribute directly to surface runoff.

PERIOD OF RECORD.--June 1968 to current year.

REVISED RECORDS.--WSP 2111: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 815.00 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 12, 13, 16, 17, Dec. 30 to Jan. 6, Jan. 9, 10, Feb. 6-13, 23-26, and Mar. 8, 9. Records good except for estimated daily discharges, which are fair.

AVERAGE DISCHARGE.--21 years, 366 ft^3/s, 13.77 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,370 ft^3/s, Mar. 21, 1982, gage height, 7.85 ft; minimum daily, 42 ft^3/s, Oct. 21, 1971.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 989 ft^3/s, June 5, gage height, 5.45 ft; maximum gage height, 5.76 ft, Feb. 10, backwater from ice; minimum daily discharge, 114 ft^3/s, Oct. 15.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	124	271	588	445	432	249	376	364	579	280	204	314
2	142	263	564	428	431	247	372	362	805	268	190	425
3	150	255	543	412	419	232	454	375	863	263	180	379
4	136	253	519	400	405	257	556	357	926	251	178	391
5	128	268	491	392	397	315	556	341	983	243	184	406
6	122	279	449	415	330	296	543	325	980	230	187	415
7	119	285	423	458	295	258	544	312	968	220	181	441
8	117	296	423	591	298	248	564	299	940	208	172	450
9	120	305	406	670	302	256	559	299	916	231	168	423
10	129	403	388	690	306	262	525	302	853	245	164	392
11	125	520	355	648	310	268	499	275	800	217	162	366
12	124	580	345	655	316	276	472	272	746	233	159	342
13	119	569	352	653	325	273	445	289	725	256	192	303
14	116	581	338	621	323	275	421	292	678	277	199	311
15	114	530	331	588	312	287	400	287	614	256	196	341
16	121	636	300	550	307	326	380	282	571	230	210	333
17	155	716	305	512	298	310	362	275	545	217	204	341
18	499	739	309	486	289	385	385	268	503	189	197	323
19	745	734	304	470	266	445	381	280	465	202	190	308
20	600	769	294	455	277	417	359	348	458	217	215	296
21	489	856	301	430	291	414	339	341	481	218	272	284
22	438	912	299	407	287	411	326	314	477	216	231	244
23	411	852	377	391	265	401	314	301	469	216	235	240
24	419	810	420	379	242	389	302	293	451	218	231	240
25	398	770	399	373	246	381	351	304	425	213	221	234
26	366	738	397	381	254	375	395	327	399	220	213	226
27	343	719	428	393	259	368	360	322	388	217	206	217
28	325	682	530	365	254	373	366	311	371	218	222	209
29	307	641	540	386	---	434	397	311	343	204	260	202
30	291	609	510	417	---	418	381	316	318	206	267	197
31	280	---	470	430	---	392	---	414	---	213	265	---
TOTAL	8072	16841	12698	14891	8736	10238	12684	9758	19040	7092	6355	9593
MEAN	260	561	410	480	312	330	423	315	635	229	205	320
MAX	745	912	588	690	432	445	564	414	983	260	272	450
MIN	114	253	294	365	242	232	302	268	318	189	159	197
CFSM	.72	1.56	1.13	1.33	.86	.91	1.17	.87	1.76	.63	.57	.89
IN.	.83	1.74	1.31	1.53	.90	1.05	1.31	1.01	1.96	.73	.65	.99

CAL YR 1988 **TOTAL** 115412 **MEAN** 315 **MAX** 912 **MIN** 68 **CFSM** .87 **IN** 11.89
WTR YR 1989 **TOTAL** 135998 **MEAN** 373 **MAX** 983 **MIN** 114 **CFSM** 1.03 **IN** 14.01

04100222 NORTH BRANCH ELKHART RIVER AT COSPERVILLE, IN

LOCATION.--Lat 41°28'54", long 85°28'32", in NE1/4 NW1/4 sec.22, T.35 N., R.9 E., Noble County, Hydrologic Unit 04050001, on right bank at downstream side of bridge on County Road 900 North at Cosperville, IN, 1,300 ft downstream from Boyd Ditch, 1.7 mi upstream from Hustin Ditch, and 3.1 mi downstream from Waldron Lake.

DRAINAGE AREA.--142 mi².

PERIOD OF RECORD.--October 1971 to current year.

GAGE.--Water-stage recorder. Datum of gage is 880.12 ft above National Geodetic Vertical Datum of 1929 (levels by Indiana Department of Natural Resources).

REMARKS.--Estimated daily discharges: Jan. 4-6, Feb. 6-13, Feb. 22 to Mar. 4, and Mar. 6-8. Records good for period Oct. 1 to June 5, and poor thereafter. Flow regulated at times by dam at Waldron Lake.

AVERAGE DISCHARGE.--18 years, 138 ft³/s, 13.20 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 919 ft³/s, Mar. 23, 1982, gage height, 8.12 ft; minimum daily, 2.2 ft³/s, July 7, 1988, caused by regulation.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 365 ft³/s, Nov. 22, June 5; maximum gage height, 5.69 ft, Nov. 22; minimum daily discharge, 24 ft³/s, Aug. 8, caused by regulation.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	32	100	254	198	179	95	136	124	214	104	68	88
2	52	96	240	189	181	94	136	124	277	98	65	98
3	75	93	227	183	176	95	161	125	323	92	63	99
4	67	91	214	174	170	96	185	125	353	86	60	99
5	60	93	202	169	164	105	196	122	362	81	59	97
6	53	96	192	165	152	96	201	120	357	78	53	94
7	48	99	183	181	147	88	200	116	349	75	26	96
8	43	105	174	204	137	97	197	113	336	72	24	99
9	40	109	165	295	132	100	190	115	320	76	27	101
10	37	145	157	317	127	99	185	114	304	76	27	101
11	36	171	149	320	122	99	179	111	289	90	37	100
12	34	185	141	316	117	101	172	108	278	108	71	97
13	32	194	135	309	117	102	166	110	268	107	78	94
14	30	197	129	296	124	104	159	93	256	105	78	98
15	29	196	124	281	123	110	155	64	244	102	81	102
16	32	236	120	267	122	117	148	77	230	98	85	104
17	52	279	114	252	120	119	144	84	220	94	81	104
18	117	304	108	240	117	131	143	87	214	90	77	104
19	142	310	103	230	115	137	139	99	209	88	72	102
20	151	326	103	223	114	141	135	137	213	86	71	98
21	151	356	103	216	114	143	132	155	207	83	71	95
22	148	362	103	205	112	142	129	155	197	81	71	92
23	147	356	125	194	105	141	124	152	187	79	71	89
24	145	343	143	186	104	139	119	148	177	77	71	85
25	141	327	150	179	102	136	121	148	167	75	69	81
26	135	315	154	176	102	136	124	155	156	74	65	77
27	130	303	164	178	100	134	123	158	144	74	62	73
28	122	291	187	176	96	135	127	156	133	74	63	69
29	117	281	202	175	---	142	129	155	121	73	67	65
30	111	267	203	176	---	144	126	153	112	73	70	63
31	106	---	202	179	---	140	---	152	---	71	71	---
TOTAL	2615	6626	4970	6849	3591	3658	4581	3855	7217	2640	1954	2764
MEAN	84.4	221	160	221	128	118	153	124	241	85.2	63.0	92.1
MAX	151	362	254	320	181	144	201	158	362	108	85	104
MIN	29	91	103	165	96	88	119	64	112	71	24	63
CFSM	.59	1.56	1.13	1.56	.90	.83	1.08	.88	1.69	.60	.44	.65
IN.	.69	1.74	1.30	1.79	.94	.96	1.20	1.01	1.89	.69	.51	.72

CAL YR 1988 TOTAL 39031.2 MEAN 107 MAX 369 MIN 2.2 CFSM .75 IN 10.23
WTR YR 1989 TOTAL 51320 MEAN 141 MAX 362 MIN 24 CFSM .99 IN 13.44

04100500 ELKHART RIVER AT GOSHEN, IN

LOCATION.--Lat 41°35'36", long 85°50'55", in NE1/4 NE1/4 sec.8, T.36 N., R.6 E., Elkhart County, Hydrologic Unit 04050001, on right bank 20 ft downstream from River Avenue bridge at Goshen, IN, 0.4 mi upstream from Rock Run, and at mile 16.1.

DRAINAGE AREA.--594 mi².

PERIOD OF RECORD.--April 1931 to current year.

REVISED RECORDS.--WSP 1337: 1939(M). WSP 1557: 1954. WSP 2111: Drainage area.

GAGE.--Water stage recorder. Datum of gage is 769.43 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 20, 1931, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Jan. 9, 10, Feb. 5-13, 23-26, and Mar. 1, 2, 6-8. Records good except for estimated daily discharges, which are fair. Occasional low flow regulation at Goshen Dam, 3.4 mi upstream.

AVERAGE DISCHARGE.--58 years, 524 ft³/s, 11.98 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,380 ft³/s, Feb. 24, 1985; maximum gage height, 11.94 ft, Mar. 14, 1982; minimum daily discharge, 7.0 ft³/s, Aug. 11, 1964, result of extreme regulation.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,800 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Oct. 19	0800	1,900	5.52	June 2	[illegible]	*3,720	*8.40
Nov. 22	0500	1,850	5.44				

Minimum daily discharge, 161 ft³/s, Oct. 15.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	176	396	1020	791	770	410	592	465	1790	404	284	306
2	194	379	957	760	756	390	571	442	3530	384	267	335
3	206	360	907	744	749	401	796	445	2610	369	245	314
4	221	349	864	732	727	448	1240	435	2080	351	243	295
5	226	355	822	673	670	656	1290	432	1860	332	266	287
6	218	366	789	773	610	490	1010	413	1590	313	256	285
7	208	387	755	903	510	410	949	397	1390	297	240	304
8	199	417	719	1490	520	460	872	384	1270	276	222	391
9	193	455	677	1560	550	453	858	387	1220	340	203	413
10	187	715	657	1370	560	452	842	384	1160	364	189	351
11	180	1130	622	1260	570	455	821	367	1100	315	175	327
12	175	1020	542	1200	570	472	797	358	1090	356	211	313
13	173	930	574	1180	570	462	774	360	1070	424	250	305
14	168	965	563	1140	577	456	745	347	1000	395	224	330
15	161	894	539	1110	576	552	714	341	946	345	226	373
16	178	944	495	1050	567	565	674	300	895	327	247	365
17	364	1180	457	989	547	516	635	286	846	319	260	349
18	1290	1210	462	943	528	750	618	282	811	301	237	337
19	1690	1140	458	906	517	917	593	297	784	340	217	324
20	952	1250	479	874	513	726	565	341	933	337	246	315
21	714	1630	471	823	518	720	547	381	818	335	240	301
22	638	1800	472	769	508	674	524	395	741	337	228	290
23	620	1580	727	740	420	621	505	396	689	339	224	281
24	658	1430	979	713	390	598	486	388	62[illegible]	332	226	271
25	635	1350	811	693	430	587	495	420	575	327	219	268
26	561	1290	709	721	470	573	493	459	533	335	208	262
27	523	1280	707	775	481	560	470	447	560	350	201	249
28	489	1250	888	731	466	555	520	424	516	323	216	244
29	459	1150	952	727	---	647	543	440	463	301	238	237
30	435	1070	865	783	---	708	501	473	431	310	249	226
31	414	---	803	789	---	631	---	477	---	309	236	---
TOTAL	13505	28672	21742	28682	15639	17257	21040	12163	33924	10487	7193	9248
MEAN	436	956	701	925	559	557	701	392	1131	338	232	308
MAX	1690	1800	1020	1560	770	917	1290	477	3530	424	284	413
MIN	161	349	457	673	390	390	470	282	431	276	175	226
CFSM	.73	1.61	1.18	1.56	.94	.94	1.18	.66	1.90	.57	.39	.52
IN.	.85	1.80	1.36	1.80	.98	1.08	1.32	.76	2.12	.66	.45	.58

CAL YR 1988 TOTAL 184507 MEAN 504 MAX 3010 MIN 88 CFSM .85 IN 11.55
WTR YR 1989 TOTAL 219552 MEAN 602 MAX 3530 MIN 161 CFSM 1.01 IN 13.75

04101000 ST. JOSEPH RIVER AT ELKHART, IN

LOCATION.--Lat 41°41'30", long 85°58'30", in SW1/4 NE1/4 sec.5, T.37 N., R.5 E., Elkhart County, Hydrologic Unit 04050001, on left bank 200 ft downstream from Elkhart River, 200 ft upstream from Main Street bridge in Elkhart, IN, 2,000 ft downstream from Christiana Creek, 0.5 mi downstream from Elkhart Hydroelectric Plant, and at mile 76.5.

DRAINAGE AREA.--3,370 mi².

PERIOD OF RECORD.--August 1947 to current year. Gage heights at site 0.8 mi downstream at different datum from September 1924 to March 1926 are available in the Indiana District Office.

REVISED RECORDS.--WSP 2111: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 700.00 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--No estimated daily discharges. Records good. Flow regulated by Elkhart Hydroelectric Plant.

AVERAGE DISCHARGE.--42 years, 3,218 ft³/s, 12.97 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 18,800 ft³/s, Feb. 27, 1985; maximum gage height, 27.91 ft, Mar. 21, 1982; minimum daily discharge, 336 ft³/s, Aug. 5, 1964.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 15,600 ft³/s, June 4, gage height, 26.16 ft; minimum daily, 1,400 ft³/s, Oct. 10.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1440	2840	5360	4650	4160	2800	4630	3460	6900	3460	2160	2460
2	1820	2650	5310	4710	4400	2790	4570	3390	11900	3270	2260	2790
3	1850	2810	5220	4540	4200	2800	5310	3390	14400	3160	2140	3040
4	1820	2590	4890	3940	4080	2840	6090	3340	15000	2950	2130	2930
5	1850	2560	4480	3950	4020	3420	6120	3270	14400	2780	2280	2990
6	1830	2640	4800	4460	3720	3170	5850	3110	13400	2580	2380	3090
7	1620	2820	4080	4420	3260	2090	6110	3060	12300	2540	2510	3120
8	1630	2940	4240	5480	3020	2940	5660	2770	11100	2300	2220	3090
9	1720	3260	4310	5160	3210	3390	5680	2950	10100	2670	2040	3000
10	1400	4210	4030	5320	3660	2940	5220	2940	9350	2570	2010	3120
11	1490	5270	3950	5380	3570	3020	5400	2920	8420	2700	1830	2730
12	1700	5270	3350	5910	3690	3210	4990	2790	7730	2630	1760	2760
13	1580	5490	3560	5650	3800	3260	4710	2850	7640	2590	1860	2780
14	1510	5680	3660	5190	3600	3420	4520	2510	7020	2750	1540	2780
15	1470	5470	3770	5320	3370	3640	4480	2620	6560	2440	1940	2880
16	1520	5320	3770	5140	3380	3990	4610	2850	6020	1890	1830	2750
17	1840	5710	3350	4770	3530	3800	3950	2700	6060	2510	1930	2730
18	4140	5860	3160	4650	3160	4430	4010	2520	5390	2160	1630	2860
19	5030	5510	3160	4680	3060	4910	4140	2780	5020	2210	1730	2660
20	4000	5830	3410	4420	3160	4620	3740	2840	5150	2350	1900	2460
21	3850	6650	3670	4410	3100	4880	3840	2900	4920	2280	2120	2710
22	3680	6610	3530	4090	3310	4500	3720	3020	4380	2440	2270	2340
23	3780	6490	4050	3890	2960	4400	3590	3050	4280	2650	1990	1810
24	3530	6420	4830	4260	2950	4330	3520	2910	4710	2950	2100	2090
25	3750	6340	4480	3650	2920	3960	3560	2940	3980	2480	2040	2270
26	3320	5910	3980	4100	2970	4230	3630	2950	4330	2810	2020	2420
27	3360	5930	4530	4040	2960	3920	3620	3160	4190	2700	1950	2170
28	3290	5970	4680	3920	3010	4050	3650	2870	3660	2600	1960	2030
29	3130	5850	4780	4070	---	4340	3830	2840	3970	2520	2010	1820
30	2910	5450	4480	4300	---	4630	3530	2910	3760	2440	2080	1920
31	3020	---	4620	4300	---	4510	---	3120	---	2440	1950	---
TOTAL	78880	146350	129490	142770	96230	115230	136280	91730	226040	80820	62570	78600
MEAN	2545	4878	4177	4605	3437	3717	4543	2959	7535	2607	2018	2620
MAX	5030	6650	5360	5910	4400	4910	6120	3460	15000	3460	2510	3120
MIN	1400	2560	3160	3650	2920	2090	3520	2510	3660	1890	1540	1810
CFSM	.76	1.45	1.24	1.37	1.02	1.10	1.35	.88	2.24	.77	.60	.78
IN.	.87	1.62	1.43	1.58	1.06	1.27	1.50	1.01	2.50	.89	.69	.87

CAL YR 1988 TOTAL 1111917 MEAN 3038 MAX 8550 MIN 613 CFSM .90 IN 12.27
WTR YR 1989 TOTAL 1384990 MEAN 3794 MAX 15000 MIN 1400 CFSM 1.13 IN 15.29

04101500 ST. JOSEPH RIVER AT NILES, MI
(National stream quality accounting network station)

LOCATION.--Lat 41°49'45", long 86°15'35", in SW1/4 sec.26, T.7 S., R.17 W., Berrien County, Hydrologic Unit 04050001, on right bank 100 ft upstream from Main Street Bridge in Niles, 0.6 mi downstream from dam at French Paper Co., 1.3 mi upstream from Dowagiac River, and at mile 44.

DRAINAGE AREA.--3,666 mi².

WATER DISCHARGE RECORDS

PERIOD OF RECORD.--October 1930 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1387: 1931, 1933-36, 1940-43, 1945-46(M). WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 633.02 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 1, 1968, at datum 2.00 ft higher. Oct. 1, 1930, to Feb. 11, 1931, nonrecording gage on Main Street Bridge, and Feb. 12 to June 30, 1931, nonrecording gage 50 ft upstream from present site (gage heights referred to NGVD). Since Apr. 13, 1970, auxiliary water-stage recorder at sewage-treatment plant, 1.1 mi downstream from base gage at same datum. Oct. 1, 1943, to Apr. 12, 1970, auxiliary gage was headwater gage at hydroelectric plant at Buchanan Dam, 8 mi downstream from base gage at different datum.

REMARKS.--No estimated daily discharges. Water discharge records good. Flow regulated by powerplants upstream from station.

AVERAGE DISCHARGE.--59 years, 3,318 ft³/s, 12.29 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 20,200 ft³/s, Apr. 5, 1950, gage height, 15.10 ft, present datum; minimum daily, 420 ft³/s, Aug. 30, 1931.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 16,300 ft³/s, June 4, gage height, 13.33 ft; minimum daily, 1,640 ft³/s, Oct. 1, 11.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1640	3430	5490	4940	4570	3360	4900	3810	6940	3820	2670	2970
2	2000	2730	5750	5010	4770	3110	4950	3680	12500	3810	2500	3050
3	2000	3080	5480	5000	4670	3150	5640	3710	15600	3590	2590	3390
4	1970	3110	5530	4660	4580	3270	7130	3720	16000	3420	2380	3520
5	2010	3020	4850	4310	4500	3650	7110	3520	15300	3070	2740	3250
6	1960	2990	5020	4650	4090	4040	6700	3710	14100	2980	2650	3470
7	1770	3090	4870	5100	3700	2870	6490	3270	13100	2870	2870	3580
8	1690	3290	4340	6500	3400	2790	6310	3070	11900	2770	2600	3560
9	1870	3660	4680	6170	3540	3660	5930	3390	10900	3830	2540	3690
10	1670	4910	4360	5860	3370	3740	5950	3200	10200	3080	2290	3560
11	1640	6500	4320	5900	3900	3360	5610	3260	9360	3140	2170	3270
12	1770	6190	4020	6240	3750	3680	5700	3190	8870	3180	2090	3030
13	1890	5910	3510	6210	4110	3630	5060	3140	8100	2930	2110	3310
14	1810	6540	3980	6080	4100	3760	4940	2960	7800	3100	1980	3150
15	1710	5910	4110	5310	3890	4040	4880	2880	7220	3020	2000	3280
16	1700	5780	3870	5680	3710	4410	5070	2930	6540	2660	2220	3200
17	2170	6260	3950	5190	3730	4220	4790	3190	6390	2280	2010	3140
18	4810	6260	3710	5040	4150	4870	4340	2850	6360	2930	2170	3100
19	6060	6380	3450	4960	3260	5260	4520	3240	5460	2450	1700	3180
20	4850	6290	3510	4950	3260	5420	4210	3130	5490	2700	2210	2950
21	4380	7660	3800	4820	3830	5040	4180	3170	5530	2810	2310	2840
22	4200	7460	4250	4600	3550	5160	4100	3430	5040	2840	2570	3000
23	4190	7250	4300	4270	3610	4630	4060	3440	4620	2890	2280	2500
24	4200	7010	5530	4480	3370	4850	3850	3430	4850	3110	2470	2020
25	4160	6640	5690	4330	3210	4400	3980	3350	4840	3420	2360	2550
26	4000	6630	4470	4190	3170	4400	3900	3320	4480	2840	2300	2720
27	3620	6230	4710	4620	3450	4510	4060	3250	5220	3210	2320	2580
28	3730	6350	5370	4220	3300	4400	4190	3370	4030	2990	2490	2420
29	3470	6330	5320	4420	---	4770	4080	3290	4180	2910	2460	2280
30	3340	6110	5200	4620	---	5040	4070	3390	4370	2870	2380	2070
31	3510	---	4910	4870	---	4940	---	3480	---	2830	2360	---
TOTAL	89790	163020	142350	157200	106540	128430	150700	102770	245290	94350	72780	90630
MEAN	2896	5434	4592	5071	3805	4143	5023	3315	8176	3044	2348	3021
MAX	6060	7660	5750	6500	4770	5420	7130	3810	16000	3830	2870	3690
MIN	1640	2730	3450	4190	3170	2790	3850	2850	4030	2280	1700	2020
CFSM	.79	1.48	1.25	1.38	1.04	1.13	1.37	.90	2.23	.83	.64	.82
IN.	.91	1.65	1.44	1.60	1.08	1.30	1.53	1.04	2.49	.96	.74	.92

CAL YR 1988 TOTAL 1236124 MEAN 3377 MAX 9790 MIN 843 CFSM .92 IN 12.54
WTR YR 1989 TOTAL 1543850 MEAN 4230 MAX 16000 MIN 1640 CFSM 1.15 IN 15.67

04101500 ST. JOSEPH RIVER AT NILES, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967, 1972-75, 1979 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: February 1979 to September 1984.
WATER TEMPERATURE: February 1979 to September 1984.

INSTRUMENTATION.--Water-quality monitor from Oct. 9, 1980 to Sept. 30, 1984.

REMARKS.--Bimonthly cross-sectional samples were collected at Grant Street bridge 0.2 mi upstream from gage.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1982, 1984): Maximum, 678 microsiemens, Feb. 16, 1982; minimum, 278 microsiemens, Mar. 19, 1982.
WATER TEMPERATURE (water years 1980, 1982-84): Maximum daily recorded (more than 20 percent missing record), 29.0°C, July 20, 21, 1980; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1986 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
NOV										
16...	1300	5740	569	8.2	8.5	2.5	11.2	99	K17000	K10000
JAN										
18...	1530	5040	572	8.3	2.0	2.3	13.6	103	K6400	460
MAR										
15...	1400	3940	590	8.4	6.0	3.5	12.2	100	E2700	1200
MAY										
08...	1400	2770	571	8.6	14.0	3.1	10.4	104	K100	K71
JUL										
18...	1300	2980	570	8.4	23.5	4.5	7.9	96	K200	K1000
SEP										
12...	1330	3020	548	8.5	21.5	3.5	8.4	97	2200	K240

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
NOV										
16...	260	93	73	20	12	9	0.3	2.6	210	0
JAN										
18...	270	72	75	21	13	9	0.4	2.3	246	0
MAR										
15...	290	74	79	23	14	9	0.4	2.1	256	5
MAY										
08...	280	72	76	22	14	10	0.4	2.0	234	10
JUL										
18...	280	50	76	21	14	10	0.4	2.2	251	7
SEP										
12...	270	75	74	21	15	11	0.4	2.3	234	2

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)
NOV									
16...	172	63	22	0.1	8.9	325	0.44	5040	0.02
JAN									
18...	202	61	23	0.1	7.2	341	0.46	4640	0.02
MAR									
15...	218	55	23	0.2	6.0	354	0.48	3770	0.03
MAY									
08...	208	56	24	0.2	3.1	304	0.41	2270	0.02
JUL									
18...	226	47	23	0.2	8.6	301	0.41	2420	0.02
SEP									
12...	196	50	23	0.1	7.1	319	0.43	2600	0.02

04101500 ST. JOSEPH RIVER AT NILES, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)
NOV 16...	2.6	0.20	0.19	1.3	0.06	0.04	0.02	<10	4	50
JAN 18...	2.3	0.14	0.12	0.70	0.02	0.01	<0.01	--	--	--
MAR 15...	2.3	0.15	0.12	0.50	0.04	0.01	0.04	<10	1	54
MAY 08...	1.4	0.16	0.12	0.90	0.06	0.01	0.01	<10	1	54
JUL 18...	1.3	0.09	0.11	0.90	0.06	0.01	<0.01	--	--	--
SEP 12...	0.79	0.04	0.03	1.1	0.06	<0.01	<0.01	<10	1	68

DATE	BERYLLIUM, DISSOLVED (UG/L AS BE)	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)
NOV 16...	<0.5	1	<1	<3	1	38	<5	9	14	<0.1
JAN 18...	--	--	--	--	--	--	--	--	--	--
MAR 15...	<0.5	<1	<1	<3	1	7	<5	7	27	<0.1
MAY 08...	<0.5	2	<1	<3	2	6	<1	<4	5	<0.1
JUL 18...	--	--	--	--	--	--	--	--	--	--
SEP 12...	<0.5	<1	<1	<3	2	12	<1	6	<1	<0.1

DATE	MOLYBDENUM, DISSOLVED (UG/L AS MO)	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
NOV 16...	<10	2	<1	1.0	120	<6	6	23	356	85
JAN 18...	--	--	--	--	--	--	--	4	54	100
MAR 15...	<10	1	<1	1.0	130	<6	5	12	128	77
MAY 08...	<10	1	<1	<1.0	140	<6	4	12	90	82
JUL 18...	--	--	--	--	--	--	--	33	266	92
SEP 12...	<10	2	<1	<1.0	140	<6	8	36	294	90

04101800 DOWAGIAC RIVER AT SUMNERVILLE, MI

LOCATION.--Lat 41°54'48", long 86°12'47", in SE1/4 sec.30, T.6 S., R.16 W., Cass County, Hydrologic Unit 04050001, on right bank 30 ft upstream from bridge on Indian Lake Road, 0.3 mi west of Sumnerville.

DRAINAGE AREA.--255 mi².

PERIOD OF RECORD.--October 1960 to current year.

GAGE.--Water-stage recorder. Datum of gage is 692.62 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--No estimated daily discharges. Records good. Flow regulated by millpond and lake-level control dam upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--29 years, 289 ft³/s, 15.39 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,590 ft³/s, Feb. 24, 1985, gage height, 9.26 ft; minimum, 86 ft³/s, Sept. 10, 1964; minimum gage height, 2.57 ft, Aug. 8, 9, 1964.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 968 ft³/s, Nov. 10, gage height, 7.05 ft; minimum, 145 ft³/s, Aug. 19, gage height, 3.16 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	182	273	386	381	361	270	383	269	713	271	204	285
2	220	264	372	365	344	268	368	268	691	251	197	318
3	234	259	365	352	326	269	474	270	531	242	190	266
4	216	265	355	344	310	295	526	261	479	231	212	247
5	224	295	347	337	304	326	488	261	401	223	321	232
6	217	332	340	374	296	312	431	251	349	214	267	222
7	209	427	332	397	298	287	396	244	313	205	250	226
8	200	475	322	574	294	285	374	241	290	196	233	220
9	195	433	314	506	284	282	351	244	274	216	219	225
10	195	887	311	442	296	301	340	243	262	222	210	219
11	191	901	306	400	295	351	335	235	245	206	201	205
12	191	717	294	404	291	397	327	229	248	225	194	195
13	189	636	301	396	294	379	318	236	293	216	193	193
14	184	549	301	368	297	382	309	236	300	203	181	212
15	178	482	313	358	302	423	309	235	280	192	174	224
16	182	520	301	348	298	392	301	232	271	287	169	208
17	235	514	294	343	288	374	304	228	262	182	161	201
18	495	458	292	344	281	642	300	223	248	178	155	194
19	442	472	293	353	280	545	296	235	242	194	147	188
20	377	535	356	364	282	476	287	267	238	206	170	182
21	344	563	399	346	289	454	284	249	223	234	175	178
22	384	510	367	335	286	408	278	237	210	294	174	175
23	408	457	570	337	272	385	270	230	203	253	194	168
24	487	424	537	339	265	368	264	221	198	235	191	166
25	524	401	458	343	279	356	305	242	195	235	180	166
26	436	390	406	366	277	345	333	250	217	261	174	164
27	374	427	442	358	278	339	301	228	590	240	169	161
28	345	414	548	345	275	377	296	218	465	224	177	162
29	315	406	489	358	---	541	293	221	341	211	192	159
30	294	398	426	382	---	481	278	236	295	214	185	156
31	281	---	401	373	---	415	---	390	---	218	176	---
TOTAL	8948	14084	11538	11632	8242	11725	10119	7630	9867	6879	6055	6117
MEAN	289	469	372	375	294	378	337	246	329	222	195	204
MAX	524	901	570	574	361	642	526	390	713	294	321	318
MIN	178	259	292	335	265	268	264	218	195	178	147	156
CFSM	1.13	1.84	1.46	1.47	1.15	1.48	1.32	.97	1.29	.87	.77	.80
IN.	1.31	2.05	1.68	1.70	1.20	1.71	1.48	1.11	1.44	1.00	.88	.89

CAL YR 1988 TOTAL 106566 MEAN 291 MAX 901 MIN 99 CFSM 1.14 IN 15.55
WTR YR 1989 TOTAL 112836 MEAN 309 MAX 901 MIN 147 CFSM 1.21 IN 16.46

04102500 PAW PAW RIVER AT RIVERSIDE, MI

LOCATION.--Lat 42°11'10", long 86°22'06", in SW1/4 SE1/4 sec.23, T.3 S., R.18 W., Berrien County, Hydrologic Unit 04050001, on left bank 40 ft upstream from bridge on Coloma Road, 0.8 mi east of Riverside.

DRAINAGE AREA.--390 mi².

PERIOD OF RECORD.--October 1951 to current year.

REVISED RECORDS.--WSP 1337: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 588.80 ft above National Geodetic Vertical Datum of 1929. May 10, 1966, to July 11, 1967, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 29 to Jan. 6, Jan. 12-16, and Feb. 7-14. Records good except for estimated daily discharges, which are fair. Diurnal fluctuation, principally during low flow, caused by paper mill upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--38 years, 452 ft³/s, 15.74 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,580 ft³/s, Oct. 4, 1986, gage height, 10.90 ft; minimum, 99 ft³/s, July 5, 1964, gage height, 2.66 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,760 ft³/s, Nov. 14, gage height, 9.24 ft; minimum, 256 ft³/s, July 18, Aug. 19, 20, 28; minimum gage height, 4.23 ft, July 18, Aug. 20.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	304	584	660	650	566	384	671	424	521	383	296	424
2	303	525	642	600	550	383	677	405	760	354	297	711
3	303	474	630	560	533	382	682	391	877	324	283	716
4	316	445	621	540	512	393	669	386	983	310	288	594
5	331	441	611	530	482	418	658	393	1330	300	382	540
6	331	456	594	520	461	435	638	385	1210	288	431	509
7	316	503	578	508	440	443	622	377	1010	281	415	470
8	305	584	561	545	435	434	622	366	845	274	402	406
9	301	619	543	695	435	416	608	360	708	296	388	388
10	300	726	527	755	435	414	570	356	583	300	352	403
11	293	1110	511	615	435	438	533	352	490	301	300	423
12	289	1110	487	600	430	483	508	348	443	306	287	438
13	293	1400	474	590	425	529	491	340	431	308	286	446
14	292	1710	472	580	425	558	476	336	427	318	286	440
15	290	1410	472	560	423	615	468	341	422	301	289	408
16	291	1230	476	550	421	715	460	344	420	290	280	380
17	307	1130	474	545	416	719	451	348	415	274	266	362
18	410	1010	469	522	406	763	445	336	403	257	261	343
19	440	909	462	505	397	862	438	330	389	268	257	327
20	439	860	478	501	389	833	428	345	377	273	274	305
21	440	859	521	497	392	809	420	356	362	288	286	299
22	455	845	561	490	393	786	414	362	355	319	292	290
23	501	800	608	488	391	763	407	350	350	320	306	282
24	551	756	737	488	386	716	401	333	353	305	297	286
25	591	732	758	482	376	654	422	329	377	312	287	275
26	625	718	741	496	377	604	473	365	365	364	281	273
27	606	713	755	530	383	563	496	390	372	336	267	275
28	578	729	817	539	383	545	482	391	393	331	261	267
29	585	708	820	543	---	606	462	382	402	319	265	266
30	618	686	750	555	---	757	445	374	395	310	261	263
31	625	---	700	570	---	697	---	420	---	300	264	---
TOTAL	12629	24782	18510	17149	12097	18117	15537	11315	16768	9510	9387	11809
MEAN	407	826	597	553	432	584	518	365	559	307	303	394
MAX	625	1710	820	755	566	862	682	424	1330	383	431	716
MIN	289	441	462	482	376	382	401	329	350	257	257	263
CFSM	1.04	2.12	1.53	1.42	1.11	1.50	1.33	.94	1.43	.79	.78	1.01
IN.	1.20	2.36	1.77	1.64	1.15	1.73	1.48	1.08	1.60	.91	.90	1.13

CAL YR 1988 TOTAL 178025 MEAN 486 MAX 1710 MIN 178 CFSM 1.25 IN 16.98
WTR YR 1989 TOTAL 177610 MEAN 487 MAX 1710 MIN 257 CFSM 1.25 IN 16.94

04102700 SOUTH BRANCH BLACK RIVER NEAR BANGOR, MI

LOCATION.--Lat 42°21'15", long 86°11'15", in NW1/4 sec.28, T.1 S., R.16 W., Van Buren County, Hydrologic Unit 04050002, on left bank 50 ft upstream from bridge on 66th Street, 4.9 mi northwest of Bangor.

DRAINAGE AREA.--83.6 mi^2.

PERIOD OF RECORD.--June 1966 to current year. Prior to October 1981, published as Black River near Bangor.

REVISED RECORDS.--WDR MI-81: 1973-75(M), 1979(M).

GAGE.--Water-stage recorder. Elevation of gage is 610 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 12, 13, 16-18, 30, 31, Jan. 4-16, and Feb. 5 to Mar. 8. Records good except for estimated daily discharges, which are fair. Occasional regulation caused by mills upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--23 years, 107 ft^3/s, 17.38 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,860 ft^3/s, Sept. 30, 1986, gage height, 13.63 ft; minimum, 20 ft^3/s, Sept. 28, 1966, Aug. 18, 19, 1984; minimum gage height, 1.79 ft, Aug. 18, 19, 1984.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 400 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Nov. 11	1000	508	8.60	June 2	1400	*586	*9.09
Mar. 16	0100	403	7.50				

Minimum discharge, 33 ft^3/s, Oct. 1, Aug. 19, 20, 27, 28; minimum gage height, 2.14 ft, Aug. 19, 20.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	34	65	149	144	131	62	148	72	359	61	40	68
2	43	64	144	130	119	62	132	67	554	55	37	72
3	44	63	147	118	106	62	141	63	477	51	36	59
4	44	67	158	105	95	70	164	61	371	48	38	50
5	55	89	142	100	90	80	162	59	297	45	53	46
6	50	117	129	95	88	85	145	58	233	43	59	57
7	44	220	120	100	86	82	129	57	167	41	53	64
8	42	232	111	190	85	80	117	57	115	39	46	55
9	40	202	103	170	84	78	109	58	94	46	43	54
10	39	371	98	150	82	83	103	58	84	48	40	51
11	38	495	95	130	81	117	99	57	75	44	39	47
12	39	409	92	120	80	193	96	56	70	43	38	44
13	38	383	90	115	78	191	93	57	71	43	37	42
14	38	344	88	110	77	196	90	57	70	41	36	43
15	37	266	96	105	75	347	89	56	67	39	39	43
16	37	246	90	103	74	382	86	55	64	36	38	42
17	41	236	88	101	73	297	84	54	62	36	36	41
18	64	193	87	99	72	335	82	54	59	35	35	39
19	65	168	86	104	70	323	80	55	56	37	33	38
20	64	185	121	114	69	254	77	65	55	41	38	38
21	58	211	196	110	67	221	76	64	53	43	41	37
22	61	188	168	101	66	186	75	60	50	43	40	37
23	67	159	239	99	65	159	73	57	48	40	39	37
24	99	141	271	100	65	144	70	54	53	38	39	36
25	140	128	213	104	64	133	87	88	68	38	36	37
26	131	120	163	124	64	123	102	98	61	42	35	37
27	107	166	154	136	63	116	93	80	77	43	34	36
28	92	181	253	122	63	127	85	68	98	41	34	37
29	83	178	257	121	---	225	80	63	86	39	42	36
30	74	160	200	144	---	223	76	74	71	40	39	36
31	69	---	160	143	---	177	---	179	---	42	37	---
TOTAL	1877	6047	4508	3707	2232	5213	3043	2061	4065	1321	1230	1359
MEAN	60.5	202	145	120	79.7	168	101	66.5	136	42.6	39.7	45.3
MAX	140	495	271	190	131	382	164	179	554	61	59	72
MIN	34	63	86	95	63	62	70	54	48	35	33	36
CFSM	.72	2.42	1.73	1.44	.95	2.01	1.21	.80	1.63	.51	.48	.54
IN.	.84	2.69	2.01	1.65	.99	2.32	1.35	.92	1.81	.59	.55	.60

CAL YR 1988 TOTAL 38958 MEAN 106 MAX 643 MIN 24 CFSM 1.27 IN 17.34
WTR YR 1989 TOTAL 36663 MEAN 100 MAX 554 MIN 33 CFSM 1.20 IN 16.31

04103010 KALAMAZOO RIVER NEAR MARENGO, MI

LOCATION.--Lat 42°15'42", long 84°51'21", in SW1/4 SE1/4 sec.26, T.2 S., R.5 W., Calhoun County, Hydrologic Unit 04050003, on right bank at upstream side of bridge on B Drive North, 0.8 mi south of Marengo, and 5.0 mi west of Albion.

DRAINAGE AREA.--267 mi².

PERIOD OF RECORD.--October 1986 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 910 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 18 and Feb. 7-11. Records good. Some diversion by pumping for irrigation. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,160 ft³/s, June 3, 1989, gage height, 10.18 ft; minimum, 88 ft³/s, Aug. 19, 1987, gage height, 5.90 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,160 ft³/s, June 3, gage height, 10.18 ft; minimum, 136 ft³/s, Oct. 15, 16, Feb. 24; minimum gage height, 6.26 ft, Feb. 24, result of freezeup.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	169	182	354	281	344	201	387	237	1020	302	295	301
2	187	181	334	268	341	194	358	239	1100	282	274	388
3	193	180	315	260	313	203	394	246	1140	267	256	398
4	186	185	306	253	284	219	482	246	1080	257	269	366
5	177	234	297	248	270	259	526	243	939	248	315	360
6	165	286	287	257	250	275	500	233	780	243	282	313
7	160	313	283	255	235	254	458	231	647	239	269	342
8	157	324	273	409	230	241	414	225	554	233	255	334
9	153	316	263	379	225	227	387	224	490	233	240	319
10	152	439	254	435	220	226	359	222	440	227	226	291
11	148	469	246	389	230	239	343	215	402	219	214	268
12	147	456	220	334	240	263	329	216	378	216	218	249
13	145	449	243	314	238	270	318	248	378	220	215	241
14	143	408	247	298	231	273	310	241	373	227	208	251
15	139	375	239	287	232	341	305	239	410	219	204	261
16	142	407	228	274	233	343	299	233	389	212	208	263
17	171	531	215	267	226	326	290	226	373	208	206	274
18	325	571	210	265	220	416	296	219	373	200	200	266
19	334	554	216	267	219	401	311	230	370	204	194	254
20	322	519	223	273	216	372	303	255	494	250	202	244
21	292	507	234	267	224	344	294	253	485	292	204	232
22	266	490	239	263	219	317	284	243	438	310	205	226
23	249	454	288	252	209	299	273	233	391	303	204	221
24	257	414	311	251	200	287	266	221	351	284	201	212
25	256	380	312	256	226	284	268	257	326	268	196	209
26	244	358	289	272	212	289	272	268	309	346	189	203
27	230	376	306	277	207	297	269	263	384	371	182	202
28	218	382	345	274	204	311	261	251	401	338	184	199
29	204	385	350	284	---	365	254	237	367	322	245	196
30	195	368	337	321	---	418	246	260	331	333	236	192
31	187	---	316	340	---	417	---	765	---	321	220	---
TOTAL	6313	11493	8580	9070	6698	9171	10056	7919	15913	8194	7016	8075
MEAN	204	383	277	293	239	296	335	255	530	264	226	269
MAX	334	571	354	435	344	418	526	765	1140	371	315	398
MIN	139	180	210	248	200	194	246	215	309	200	182	192
CFSM	.76	1.43	1.04	1.10	.90	1.11	1.26	.96	1.99	.99	.85	1.01
IN.	.88	1.60	1.20	1.26	.93	1.28	1.40	1.10	2.22	1.14	.98	1.13

CAL YR 1988 TOTAL 81156 MEAN 222 MAX 724 MIN 95 CFSM .83 IN 11.31
WTR YR 1989 TOTAL 108498 MEAN 297 MAX 1140 MIN 139 CFSM 1.11 IN 15.12

04105000 BATTLE CREEK AT BATTLE CREEK, MI

LOCATION.--Lat 42°19'55", long 85°09'15", in NW1/4 sec.5, T.2 S., R.7 W., Calhoun County, Hydrologic Unit 04050003, on right bank 350 ft upstream from Emmett Street Bridge in Battle Creek, 3.0 mi upstream from mouth.

DRAINAGE AREA.--241 mi^2.

PERIOD OF RECORD.--October 1930 to September 1931, October 1932 to July 1933, January 1934 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1387: 1931, 1944. WSP 1507: 1956.

GAGE.--Water-stage recorder. Datum of gage is 823.24 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to May 14, 1951, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Jan. 20-23, Mar. 7, 8, and May 22-31. Records good except for estimated daily discharges, which are fair. Occasional slight regulation prior to November 1943. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--56 years (water years 1931, 1935-89), 204 ft^3/s, 11.50 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,640 ft^3/s, Apr. 7, 1947, gage height, 4.48 ft, from floodmark; minimum, 22 ft^3/s, Aug. 14, 1934; minimum gage height, about -0.5 ft in July 1936 and on Aug. 31, 1939, due to opening of gates at dam forming control.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,630 ft^3/s, June 3, gage height, 2.76 ft; minimum, 63 ft^3/s, Aug. 28, gage height, 0.63 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	126	187	317	274	322	143	687	175	479	273	96	234
2	117	169	301	264	342	147	606	175	1220	264	89	238
3	142	159	286	224	313	157	551	178	1600	237	82	219
4	144	153	267	185	253	171	521	176	1510	206	84	184
5	141	153	253	181	233	176	530	172	1290	180	105	152
6	136	172	240	177	222	195	583	164	1090	151	116	144
7	130	201	226	185	210	190	589	160	904	135	136	142
8	121	231	214	240	205	185	536	157	741	122	146	140
9	114	278	206	238	196	200	475	153	594	117	142	204
10	98	373	197	271	186	207	426	149	487	110	123	268
11	103	466	152	316	178	233	390	145	410	102	111	313
12	94	601	154	388	173	274	362	140	358	103	103	345
13	100	727	162	405	169	314	341	151	322	100	93	348
14	87	697	159	351	168	350	324	160	297	98	82	315
15	85	613	163	300	171	380	314	167	288	106	87	267
16	85	562	150	258	161	405	302	168	275	106	92	227
17	97	514	147	228	156	511	289	156	263	98	93	195
18	133	469	139	213	152	686	281	151	253	90	84	171
19	162	446	136	217	154	679	279	155	242	84	75	154
20	185	439	152	220	153	822	266	166	231	93	89	144
21	205	432	177	210	140	833	253	171	222	103	89	134
22	218	428	180	205	140	757	240	165	217	106	92	125
23	222	438	203	200	141	658	224	160	208	102	83	114
24	222	448	219	194	142	574	225	150	194	98	80	108
25	223	428	230	195	148	512	217	170	178	103	84	98
26	230	398	235	212	145	471	193	190	164	101	77	101
27	242	375	231	221	141	450	200	185	180	97	78	93
28	253	351	252	232	140	450	207	180	202	97	71	93
29	252	333	218	254	---	479	208	175	219	92	107	92
30	238	324	200	277	---	565	187	170	252	91	178	89
31	216	---	250	293	---	701	---	300	---	98	196	---
TOTAL	4921	11565	6416	7628	5254	12875	10806	5234	14890	3863	3163	5451
MEAN	159	386	207	246	188	415	360	169	496	125	102	182
MAX	253	727	317	405	342	833	687	300	1600	273	196	348
MIN	85	153	136	177	140	143	187	140	164	84	71	89
CFSM	.66	1.60	.86	1.02	.78	1.72	1.49	.70	2.06	.52	.42	.76
IN.	.76	1.79	.99	1.18	.81	1.99	1.67	.81	2.30	.60	.49	.84

CAL YR 1988 TOTAL 76576 MEAN 209 MAX 1300 MIN 26 CFSM .87 IN 11.82
WTR YR 1989 TOTAL 92066 MEAN 252 MAX 1600 MIN 71 CFSM 1.05 IN 14.21

04105500 KALAMAZOO RIVER NEAR BATTLE CREEK, MI

LOCATION.--Lat 42°19'26", long 85°11'51", in SW1/4 sec.1, T.2 S., R.8 W., Calhoun County, Hydrologic Unit 04050003, on left bank 20 ft upstream from bridge on Kendall Street in Battle Creek.

DRAINAGE AREA.--824 mi^2.

PERIOD OF RECORD.--July 1937 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 924: 1938-39. WSP 1387: 1938, 1945-46, 1948.

GAGE.--Water-stage recorder. Elevation of gage is 815 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to Oct. 1, 1957, water-stage recorder at site 4.7 mi downstream at different datum. Oct. 1, 1957, to June 15, 1959, nonrecording gage at bridge 1,800 ft upstream at different datum. June 16, 1959, to Oct. 13, 1960, nonrecording gage at same site and datum.

REMARKS.--No estimated daily discharges. Records good. Diurnal fluctuation below 1,500 ft^3/s caused by powerplants upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--52 years, 671 ft^3/s, 11.06 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,290 ft^3/s, Apr. 7, 1947, gage height, 9.13 ft, site and datum then in use; minimum, 50 ft^3/s, Sept. 22, 1939, site then in use; minimum daily, 86 ft^3/s, Aug. 5, 1964.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 4,240 ft^3/s, June 3, gage height, 6.86 ft; minimum, 354 ft^3/s, Oct. 12, 13, gage height, 3.21 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	422	617	1040	872	1040	543	1540	683	3040	918	664	869
2	576	574	977	828	1030	534	1420	661	3760	861	622	935
3	505	565	916	778	944	548	1440	677	4130	830	604	929
4	524	568	893	718	838	606	1500	681	3930	778	589	841
5	518	614	858	698	762	660	1570	672	3440	710	737	750
6	481	735	832	701	727	690	1620	642	2890	680	745	764
7	411	833	793	751	706	692	1560	622	2400	652	703	786
8	457	905	791	1020	619	680	1440	617	2010	622	679	845
9	451	973	743	1030	571	658	1310	632	1700	613	667	891
10	417	1380	726	1100	596	672	1220	603	1460	584	614	914
11	417	1520	658	1120	677	724	1130	589	1290	552	586	897
12	390	1610	548	1130	688	841	1060	584	1190	545	556	892
13	379	1700	628	1080	650	874	1000	644	1130	535	548	905
14	384	1660	726	996	661	968	951	645	1080	541	544	846
15	400	1520	723	907	640	1220	944	697	1090	537	543	808
16	428	1440	648	841	635	1260	896	656	1070	530	543	757
17	537	1450	635	795	615	1370	880	649	1010	523	539	732
18	751	1480	596	774	597	1750	862	615	973	490	523	676
19	816	1460	633	778	583	1740	869	679	916	512	496	689
20	799	1470	649	789	595	1790	855	737	982	565	518	642
21	807	1480	696	751	603	1760	841	719	1050	647	542	612
22	751	1430	722	721	592	1630	831	720	1020	754	536	595
23	751	1380	812	725	560	1460	781	644	956	702	508	560
24	783	1330	871	709	512	1310	758	621	899	673	480	546
25	807	1250	858	713	575	1240	786	819	820	649	517	520
26	791	1180	846	740	580	1180	756	825	790	633	480	514
27	751	1150	896	792	573	1160	768	768	940	727	452	501
28	743	1130	959	766	553	1230	747	718	1020	724	465	490
29	705	1100	926	832	---	1330	721	677	975	663	521	486
30	682	1040	915	906	---	1450	694	774	923	712	692	474
31	646	---	885	965	---	1560	---	2090	---	707	672	---
TOTAL	18280	35544	24399	26326	18722	34130	31750	22360	48884	20169	17885	21666
MEAN	590	1185	787	849	669	1101	1058	721	1629	651	577	722
MAX	816	1700	1040	1130	1040	1790	1620	2090	4130	918	745	935
MIN	379	565	548	693	512	534	694	584	790	490	452	474
CFSM	.72	1.44	.96	1.03	.81	1.34	1.28	.88	1.98	.79	.70	.88
IN.	.83	1.60	1.10	1.19	.85	1.54	1.43	1.01	2.21	.91	.81	.98

CAL YR 1988 TOTAL 247634 MEAN 677 MAX 2570 MIN 200 CFSM .82 IN 11.18
WTR YR 1989 TOTAL 320115 MEAN 877 MAX 4130 MIN 379 CFSM 1.06 IN 14.45

04105700 AUGUSTA CREEK NEAR AUGUSTA, MI

LOCATION.--Lat 42°21'12", long 85°21'14", in SW1/4 sec.27, T.1 S., R.9 W., Kalamazoo County, Hydrologic Unit 04050003, on left bank 15 ft downstream from bridge on EF Road, 1.3 mi north of Augusta.

DRAINAGE AREA.--38.9 mi^2.

PERIOD OF RECORD.--October 1964 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 815 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to June 15, 1965, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: July 14 and Aug. 8. Records good. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--25 years, 44.3 ft^3/s, 15.47 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 560 ft^3/s, June 27, 1978, gage height, 3.41 ft; minimum, 8.9 ft^3/s, Jan. 26, 1978, result of freezeup; minimum gage height, 0.65 ft, Jan. 19, 1970.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 218 ft^3/s, June 1, gage height, 2.85 ft; minimum, 17 ft^3/s, Feb. 23, gage height, 0.75 ft, result of freezeup.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	39	44	55	47	56	38	68	38	184	51	40	53
2	49	43	53	45	51	37	62	38	201	48	37	55
3	52	42	52	44	46	39	70	40	147	45	36	49
4	49	43	50	40	43	43	74	39	114	43	40	44
5	47	48	50	43	42	47	71	38	93	41	48	41
6	44	59	49	43	41	42	67	38	79	41	44	39
7	41	65	48	46	41	40	62	37	69	39	40	45
8	40	66	47	80	40	39	57	36	63	36	34	60
9	38	64	45	66	39	39	54	36	58	39	32	128
10	37	95	44	68	42	40	52	36	53	38	30	111
11	36	106	40	57	40	47	50	34	50	36	32	83
12	36	99	41	54	40	57	51	34	50	36	43	68
13	34	92	43	52	42	52	52	37	54	37	44	60
14	34	82	42	46	42	56	50	36	53	32	39	57
15	34	74	44	47	42	71	49	35	54	29	37	53
16	37	76	40	44	41	67	47	37	53	28	35	50
17	55	79	41	44	38	64	47	37	50	30	33	48
18	75	72	40	44	38	73	47	35	48	34	32	46
19	74	70	40	45	40	66	46	39	49	36	31	43
20	67	71	47	47	40	64	44	44	53	42	36	41
21	61	72	51	42	41	62	44	42	49	42	37	39
22	57	68	49	44	40	57	43	38	49	40	37	38
23	56	64	64	42	35	54	42	36	52	38	36	36
24	66	61	61	43	38	53	40	34	72	36	36	36
25	75	58	56	44	40	56	44	52	68	36	34	35
26	70	57	51	52	38	58	44	55	66	37	32	34
27	63	61	56	50	39	58	42	46	74	40	31	33
28	58	61	61	47	39	67	41	41	67	43	31	32
29	52	58	56	52	---	85	40	37	60	40	36	32
30	48	56	49	58	---	84	40	55	55	43	44	32
31	45	---	51	55	---	76	---	131	---	43	39	---
TOTAL	1569	2006	1516	1531	1154	1731	1540	1311	2187	1199	1136	1521
MEAN	50.6	66.9	48.9	49.4	41.2	55.8	51.3	42.3	72.9	38.7	36.6	50.7
MAX	75	106	64	80	56	85	74	131	201	51	48	128
MIN	34	42	40	40	35	37	40	34	48	28	30	32
CFSM	1.30	1.72	1.26	1.27	1.06	1.43	1.32	1.09	1.87	1.00	.94	1.30
IN.	1.50	1.92	1.45	1.46	1.10	1.66	1.47	1.25	2.09	1.15	1.09	1.45

CAL YR 1988 TOTAL 16393 MEAN 44.8 MAX 112 MIN 17 CFSM 1.15 IN 15.68
WTR YR 1989 TOTAL 18401 MEAN 50.4 MAX 201 MIN 28 CFSM 1.30 IN 17.60

04106000 KALAMAZOO RIVER AT COMSTOCK, MI

LOCATION.--Lat 42°17'08", long 85°30'50", in NE1/4 sec.19, T.2 S., R.10 W., Kalamazoo County, Hydrologic Unit 04050003, on left bank at downstream side of bridge on River Street in Comstock, 0.2 mi downstream from Comstock Creek.

DRAINAGE AREA.--1,010 mi², approximately.

PERIOD OF RECORD.--April to August 1931, October 1932 to December 1979, October 1984 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 824: 1933-36. WSP 1387: 1933, 1934(M), 1935, 1936(M), 1938(M), 1940(M), 1941.

GAGE.--Water-stage recorder. Datum of gage is 756.12 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 1, 1987, at datum 3.00 ft higher. Prior to November 1945, nonrecording gage at same site and datum.

REMARKS.--No estimated daily discharges. Records good. Flow regulated by powerplant 1.2 mi upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--52 years (water years 1933-79, 1985-89), 868 ft³/s, 11.67 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,910 ft³/s, Apr. 8, 1947, gage height, 7.94 ft, datum then in use; minimum, 119 ft³/s, May 29, 1958; minimum gage height, 0.09 ft, May 29, 1958, May 23, 1987, datum then in use; minimum daily discharge, 185 ft³/s, Aug. 7, 1934.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 4,910 ft³/s, June 4, gage height, 9.37 ft; minimum, 385 ft³/s, Apr. 25, gage height, 3.65 ft; minimum daily, 567 ft³/s, Aug. 25.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	930	984	1380	1290	1420	771	1920	994	2760	1210	930	899
2	861	995	1410	1230	1350	771	1820	989	3440	1140	841	956
3	920	925	1310	1130	1320	838	1760	912	4140	1050	723	990
4	934	908	1280	1050	1250	836	1860	908	4720	1040	822	1100
5	854	914	1230	1040	1110	921	1800	918	4490	1010	811	1010
6	841	921	1150	1040	997	985	1790	907	3990	982	938	952
7	840	1030	1160	1030	991	919	1830	937	3460	927	931	951
8	635	1180	1150	1170	987	911	1830	778	2900	820	837	973
9	785	1320	1140	1330	727	989	1690	912	2460	829	849	1170
10	705	1850	1100	1250	708	981	1560	847	2020	768	845	1260
11	776	1830	1040	1540	955	984	1470	850	1820	776	757	1230
12	631	1880	928	1500	1050	993	1460	826	1730	768	793	1140
13	699	1980	907	1400	1050	1030	1340	845	1520	729	716	1130
14	698	2050	994	1370	1030	1270	1270	866	1480	730	659	1250
15	691	1950	1010	1290	1000	1390	1280	844	1490	731	716	1100
16	635	1990	1010	1160	985	1570	1270	911	1470	677	710	1050
17	846	1790	997	1100	886	1590	1200	931	1360	656	710	1010
18	1030	1740	860	1070	842	1840	1170	907	1380	676	680	985
19	1060	1830	920	1050	869	1960	1140	981	1310	781	637	968
20	1170	1840	998	1070	916	2080	1110	852	1200	728	653	955
21	1180	1860	997	1080	920	2090	1130	919	1280	814	624	949
22	1140	1860	1000	1050	778	2070	1120	988	1490	799	704	887
23	1130	1770	991	1020	917	1880	1110	978	1290	876	700	803
24	1170	1670	1160	1020	764	1670	1050	906	1270	887	697	815
25	1230	1670	1220	1020	703	1540	1020	908	1200	866	567	737
26	1210	1590	1170	1030	936	1510	1050	1010	1070	804	613	760
27	1160	1570	1320	1060	920	1500	1050	1030	1340	869	644	688
28	1080	1500	1320	1090	844	1520	1050	1020	1380	940	616	718
29	1100	1480	1330	1120	---	1760	1030	1000	1310	872	591	758
30	1070	1390	1140	1160	---	1710	1000	993	1120	817	748	691
31	1010	---	1130	1290	---	1670	---	2120	---	866	901	---
TOTAL	29021	46267	34752	36050	27225	42549	41180	29787	61890	26438	22963	28885
MEAN	936	1542	1121	1163	972	1373	1373	961	2063	853	741	963
MAX	1230	2050	1410	1540	1420	2090	1920	2120	4720	1210	938	1260
MIN	631	908	860	1020	703	771	1000	778	1070	656	567	688
CFSM	.93	1.53	1.11	1.15	.96	1.36	1.36	.95	2.04	.85	.73	.95
IN.	1.07	1.70	1.28	1.33	1.00	1.57	1.52	1.10	2.28	.97	.85	1.06

CAL YR 1988 TOTAL 352507 MEAN 963 MAX 2830 MIN 340 CFSM .95 IN 12.98
WTR YR 1989 TOTAL 427007 MEAN 1170 MAX 4720 MIN 567 CFSM 1.16 IN 15.73

04106180 PORTAGE CREEK AT PORTAGE, MI

LOCATION.--Lat 42°12'21", long 85°35'23", in SE1/4 sec.16, T.3 S., R.11 W., Kalamazoo County, Hydrologic Unit 04050003, on right bank 750 ft upstream from bridge on Westnedge Avenue in Portage.

DRAINAGE AREA.--16.5 mi^2.

PERIOD OF RECORD.--October 1982 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 850 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--No estimated daily discharges. Records fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--7 years, 18.9 ft^3/s, 15.56 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 118 ft^3/s, May 31, 1989, gage height, 3.87 ft; minimum daily, 10 ft^3/s, Sept. 15, 1988; minimum gage height, 1.79 ft, June 8, 9, 10, 16, 17, 18, 19, 1987.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 118 ft^3/s, May 31, gage height, 3.87 ft; minimum daily, 15 ft^3/s, Oct. 1, 8, 9, Sept. 20-30; minimum gage height, 1.96 ft, Sept. 30.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	15	17	20	20	21	18	20	19	60	20	18	33
2	19	17	19	20	20	18	20	19	40	20	18	23
3	18	17	19	20	19	18	28	20	33	20	18	19
4	17	17	19	19	19	21	29	19	29	19	22	18
5	17	18	19	19	19	20	24	19	24	19	25	17
6	16	21	19	20	19	19	21	19	23	19	21	17
7	16	29	19	22	19	18	21	18	22	19	19	18
8	15	25	19	32	19	18	20	18	21	19	18	17
9	15	26	18	23	19	18	20	18	21	21	18	17
10	16	55	19	21	19	18	20	18	21	20	18	17
11	17	35	18	20	19	21	20	18	20	19	18	17
12	17	26	18	21	19	22	20	18	21	20	18	16
13	17	25	18	21	19	21	20	19	26	20	18	17
14	17	22	18	20	19	23	19	18	24	19	18	18
15	17	20	19	20	19	27	20	18	23	19	18	17
16	19	32	18	19	19	22	19	18	22	18	18	17
17	25	26	18	19	19	27	20	18	21	18	18	17
18	36	21	18	19	18	42	20	18	21	18	17	16
19	26	23	18	20	18	27	19	19	23	19	17	16
20	20	28	21	21	19	23	19	19	22	20	18	15
21	19	28	21	20	19	22	19	18	21	20	18	15
22	19	23	21	20	19	20	19	18	21	20	18	15
23	21	21	30	20	18	20	18	17	21	19	18	15
24	28	20	24	20	18	20	18	17	22	18	18	15
25	28	20	21	20	18	20	21	21	21	19	17	15
26	21	20	20	22	18	20	20	19	20	19	17	15
27	19	23	27	21	18	20	19	18	35	19	17	15
28	18	21	27	20	18	27	19	17	27	19	17	15
29	18	20	23	22	---	31	19	17	22	18	17	15
30	17	20	21	23	---	24	19	31	21	19	17	15
31	17	---	20	22	---	21	---	83	---	19	17	---
TOTAL	600	716	629	646	527	686	610	646	748	595	564	512
MEAN	19.4	23.9	20.3	20.8	18.8	22.1	20.3	20.8	24.9	19.2	18.2	17.1
MAX	36	55	30	32	21	42	29	83	60	21	25	33
MIN	15	17	18	19	18	18	18	17	20	18	17	15
CFSM	1.18	1.45	1.23	1.26	1.14	1.34	1.23	1.26	1.51	1.16	1.10	1.04
IN.	1.35	1.61	1.42	1.46	1.19	1.55	1.38	1.46	1.69	1.34	1.27	1.15

CAL YR 1988 TOTAL 6824 MEAN 18.6 MAX 55 MIN 10 CFSM 1.13 IN 15.38
WTR YR 1989 TOTAL 7479 MEAN 20.5 MAX 83 MIN 15 CFSM 1.24 IN 16.86

04106300 PORTAGE CREEK NEAR KALAMAZOO, MI

LOCATION.--Lat 42°14'46", long 85°34'33", in SE1/4 sec.34, T.2 S., R.11 W., Kalamazoo County, Hydrologic Unit 04050003, on left bank 5 ft upstream from bridge on Lovers Lane, 3.0 mi south of Kalamazoo.

DRAINAGE AREA.--22.4 mi^2.

PERIOD OF RECORD.--October 1964 to current year.

GAGE.--Water-stage recorder. Datum of gage is 814.88 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--No estimated daily discharges. Records fair. Flow includes water which is pumped from ground-water sources by industry and discharged into stream 2.0 mi upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--25 years, 40.6 ft^3/s, 24.61 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 407 ft^3/s, May 30, 1989, gage height, 3.09 ft; maximum gage height, 4.49 ft, June 26, 1978; minimum discharge, 8.0 ft^3/s, Jan. 19, 1965, gage height, 0.88 ft, result of bridge construction upstream.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 120 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Oct. 17	2300	139	1.95	May 30	2330	*407	*3.09
Nov. 10	0600	156	2.01	Sept. 1	1030	154	2.06
Mar. 18	0030	172	2.06				

Minimum daily discharge, 28 ft^3/s, Sept. 26, 27, 29.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	31	42	46	40	46	37	49	46	131	46	54	99
2	41	43	44	36	43	39	48	49	80	44	54	50
3	32	46	44	40	40	41	73	49	70	42	54	42
4	31	51	42	40	38	55	70	49	61	41	80	38
5	30	51	42	42	35	45	59	48	55	44	84	39
6	34	53	42	45	40	41	52	42	54	46	61	43
7	41	63	43	49	42	41	51	40	52	46	56	45
8	42	51	41	72	41	40	50	44	50	46	55	42
9	42	52	39	50	41	41	46	44	49	56	55	43
10	39	120	41	48	40	43	46	45	45	50	57	40
11	38	65	38	39	39	47	45	45	44	50	58	40
12	39	54	38	37	38	48	47	46	52	55	56	41
13	39	55	42	35	41	47	46	49	60	53	54	42
14	39	52	46	32	40	50	48	45	57	51	55	42
15	38	49	47	35	40	59	49	49	53	50	56	41
16	51	75	45	35	38	49	46	46	49	50	52	39
17	63	54	45	35	38	67	52	44	47	49	52	37
18	80	46	45	41	37	100	51	45	44	36	44	38
19	57	52	48	50	37	58	52	53	57	40	33	39
20	47	60	54	51	39	58	51	51	51	43	43	36
21	46	55	52	45	42	54	49	46	45	37	36	39
22	44	48	53	45	40	51	47	46	46	37	43	38
23	51	46	74	47	37	50	46	48	47	32	37	35
24	67	47	54	47	37	48	48	45	51	42	35	36
25	59	46	50	46	39	47	60	65	42	59	34	35
26	48	46	49	48	37	47	53	47	44	55	34	28
27	46	52	71	43	37	52	51	43	79	61	35	28
28	44	46	57	42	37	76	49	43	52	55	36	29
29	43	46	48	43	---	74	47	43	46	51	37	28
30	41	46	44	47	---	58	44	93	46	56	36	29
31	43	---	40	47	---	54	---	257	---	55	38	---
TOTAL	1386	1612	1464	1352	1099	1617	1525	1705	1659	1478	1514	1201
MEAN	44.7	53.7	47.2	43.6	39.3	52.2	50.8	55.0	55.3	47.7	48.8	40.0
MAX	80	120	74	72	46	100	73	257	131	61	84	99
MIN	30	42	38	32	35	37	44	40	42	32	33	28

CAL YR 1988 TOTAL 14977 MEAN 40.9 MAX 130 MIN 20
WTR YR 1989 TOTAL 17612 MEAN 48.3 MAX 257 MIN 28

04106320 WEST FORK PORTAGE CREEK NEAR OSHTEMO, MI

LOCATION.--Lat 42°14'07", long 85°38'54", in SE1/4 sec.1, T.3 S., R.12 W., Kalamazoo County, Hydrologic Unit 04050003, on right bank at upstream side of culvert on 12th Street, 2.1 mi southeast of Oshtemo.

DRAINAGE AREA.--13.0 mi^2.

PERIOD OF RECORD.--May 1972 to current year.

GAGE.--Water-stage recorder. Datum of gage is 868.86 ft, Kalamazoo County Road Commission datum.

REMARKS.--Estimated daily discharges: Feb. 2-28. Records good except for estimated daily discharges, which are fair. At times, flow is affected by ground-water withdrawals. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--17 years, 6.53 ft^3/s, 6.82 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 26 ft^3/s, Aug. 31, 1975, gage height, 2.15 ft; minimum, 0.38 ft^3/s, July 14, 15, 1988, gage height, 0.89 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 17 ft^3/s, June 1, gage height, 1.75 ft; minimum, 3.1 ft^3/s, May 11, 12, gage height, 1.11 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.4	4.9	6.3	5.9	6.0	5.4	6.4	4.4	17	5.6	4.1	6.1
2	5.0	4.6	6.1	5.7	5.8	5.5	6.2	4.4	15	5.5	4.1	6.6
3	4.9	4.6	6.0	5.5	5.6	5.5	7.1	4.5	14	5.3	4.1	6.6
4	4.7	4.8	5.9	5.4	5.5	6.1	7.8	4.3	12	5.1	5.3	6.3
5	4.5	5.3	5.9	5.2	5.4	6.2	7.8	4.3	9.9	5.0	7.1	5.9
6	4.3	6.2	5.7	5.4	5.3	6.0	7.6	4.1	8.4	4.7	7.2	5.7
7	4.0	7.7	5.5	5.6	5.2	5.8	7.2	4.0	7.2	4.5	6.9	5.8
8	3.8	8.2	5.4	6.9	5.3	5.6	6.8	3.7	6.3	4.4	6.5	5.6
9	3.7	8.2	5.4	6.9	5.3	5.4	6.7	3.7	5.7	4.5	6.1	5.6
10	3.7	12	5.4	6.6	5.4	5.4	6.4	3.6	5.3	4.5	5.8	5.4
11	3.6	12	5.3	6.0	5.4	5.7	6.3	3.3	4.9	4.7	5.5	5.1
12	3.6	11	5.2	5.9	5.4	5.9	6.3	3.1	4.9	5.0	5.3	4.9
13	3.7	11	5.2	5.6	5.4	6.1	6.4	3.4	5.4	4.8	5.1	4.9
14	3.7	10	5.3	5.4	5.4	6.4	6.8	3.5	5.5	4.6	5.0	4.9
15	3.9	9.1	5.2	5.4	5.4	7.3	7.2	3.6	5.7	4.6	4.7	4.6
16	4.5	9.8	5.2	5.3	5.4	7.1	7.1	3.5	5.5	4.5	4.5	4.6
17	6.5	9.9	5.2	5.1	5.4	7.1	6.9	3.6	5.3	4.4	4.4	4.4
18	9.8	9.1	5.2	5.0	5.4	9.3	6.6	3.7	5.2	4.3	4.2	4.4
19	11	9.2	5.2	5.0	5.4	9.1	6.5	3.6	5.4	4.4	4.1	4.3
20	9.9	9.7	5.6	5.2	5.5	8.6	6.2	4.2	5.6	4.8	4.4	4.1
21	8.9	10	5.7	5.2	5.6	8.2	5.8	3.9	5.5	5.2	4.4	4.1
22	8.1	9.8	5.8	5.2	5.5	7.6	5.6	3.8	5.4	5.2	4.5	4.2
23	7.6	9.1	7.2	5.0	5.4	7.1	5.4	3.6	5.5	5.1	4.6	4.3
24	8.5	8.6	7.1	5.0	5.4	6.8	5.1	3.6	6.5	4.9	4.5	4.3
25	9.1	8.0	6.6	5.0	5.4	6.6	5.3	4.1	6.2	5.0	4.3	4.4
26	8.6	7.7	6.0	5.5	5.4	6.5	5.4	4.2	6.0	5.0	4.1	4.6
27	7.8	7.8	7.0	5.6	5.4	6.5	5.3	4.0	7.0	4.8	4.1	4.6
28	6.8	7.2	7.7	5.5	5.4	7.3	5.2	3.7	6.8	4.6	4.1	4.6
29	6.0	6.8	7.1	5.8	---	7.9	5.0	.7	6.1	4.2	4.1	4.6
30	5.5	6.5	6.7	6.1	---	7.2	4.7	4.	5.8	4.3	3.9	4.6
31	5.2	---	6.2	6.1	---	6.8	---	13	---	4.1	3.8	---
TOTAL	185.3	248.8	183.3	173.0	152.4	208.0	189.1	129.0	215.0	147.6	150.8	150.1
MEAN	5.98	8.29	5.91	5.58	5.44	6.71	6.30	4.16	7.17	4.76	4.86	5.00
MAX	11	12	7.7	6.9	6.0	9.3	7.8	13	17	5.6	7.2	6.6
MIN	3.6	4.6	5.2	5.0	5.2	5.4	4.7	3.1	4.9	4.1	3.8	4.1
CFSM	.46	.64	.46	.43	.42	.52	.49	.32	.55	.37	.37	.39
IN.	.53	.71	.52	.50	.44	.60	.54	.37	.62	.42	.43	.43

CAL YR 1988 TOTAL 1571.39 MEAN 4.29 MAX 12 MIN .50 CFSM .33 IN 4.50
WTR YR 1989 TOTAL 2132.40 MEAN 5.84 MAX 17 MIN 3.1 CFSM .45 IN 6.10

04106400 WEST FORK PORTAGE CREEK AT KALAMAZOO, MI

LOCATION.--Lat 42°14'40", long 85°36'50", in NE1/4 sec.5, T.3 S., R.11 W., Kalamazoo County, Hydrologic Unit 04050003, on right bank 30 ft upstream from culvert on Oakland Drive, 2.5 mi upstream from mouth, and 3.7 mi southwest of main business district of Kalamazoo.

DRAINAGE AREA.--18.7 mi^2.

PERIOD OF RECORD.--September 1959 to current year.

GAGE.--Water-stage recorder and V-notch sharp-crested weir. Datum of gage is 858.09 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources).

REMARKS.--Estimated daily discharges: Dec. 7-13, 27-30, Jan. 4-25, Feb. 4-25, Mar. 7-10, Apr. 6 to June 20, and June 22 to July 10. Records good except for estimated daily discharges, which are fair. At times, flow is affected by ground-water withdrawals. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--30 years, 9.72 ft^3/s, 7.06 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 41 ft^3/s, Apr. 19, 1975, gage height, 3.32 ft; minimum, 0.91 ft^3/s, June 19, 20, 1988; minimum gage height, 0.88 ft, July 30, 1963, caused by construction.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 37 ft^3/s, June 1; minimum daily, 4.3 ft^3/s, Oct. 14, 15.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	6.4	7.1	9.2	8.5	7.9	7.0	9.6	6.7	37	9.7	7.7	14
2	7.8	6.7	8.9	8.4	7.4	7.0	9.1	6.5	32	9.5	7.2	14
3	7.5	6.4	8.6	8.7	7.3	7.0	11	6.3	27	9.2	6.9	12
4	6.8	6.5	8.6	8.4	7.3	7.5	11	6.2	23	9.0	9.0	11
5	6.7	7.2	8.5	8.0	7.2	8.3	11	6.1	20	8.7	15	9.9
6	6.2	8.2	8.4	8.3	7.1	8.1	11	6.0	17	8.1	14	10
7	5.7	11	8.3	8.7	7.1	8.0	10	5.9	14	7.8	12	12
8	5.4	11	8.1	11	7.0	7.9	10	5.8	12	7.6	10	11
9	5.1	10	8.0	11	7.0	7.7	9.7	5.7	11	7.8	9.7	11
10	4.9	20	7.9	10	7.0	7.6	9.4	5.6	9.8	8.0	9.3	9.9
11	4.7	19	7.8	8.6	7.1	7.5	9.2	5.5	8.8	8.2	8.9	9.3
12	4.5	16	7.8	8.4	7.1	7.8	9.2	5.4	9.0	9.1	8.7	8.8
13	4.4	16	7.8	8.2	7.2	7.6	9.5	5.7	9.4	9.3	8.5	8.7
14	4.3	15	7.8	8.0	7.3	8.2	10	6.0	9.8	8.5	8.3	9.2
15	4.3	13	7.8	7.9	7.3	11	11	6.1	9.9	7.8	8.8	9.1
16	5.1	16	7.5	7.8	7.2	10	11	6.2	9.7	7.4	8.4	8.7
17	8.6	16	7.7	7.6	7.1	10	11	6.2	9.4	7.2	7.7	8.5
18	17	14	7.8	7.4	7.1	16	10	6.3	9.2	6.9	7.2	8.2
19	15	14	7.7	7.4	7.2	14	9.8	6.5	9.3	7.1	6.9	7.9
20	13	14	8.2	7.5	7.3	13	9.4	7.0	9.4	8.2	8.2	7.6
21	12	14	8.5	7.6	7.4	12	9.0	6.7	9.1	8.9	8.4	7.4
22	11	13	8.7	7.5	7.4	10	8.5	6.5	9.4	8.7	8.3	7.4
23	11	13	12	7.4	7.3	9.5	8.1	6.3	10	8.2	8.3	7.0
24	14	12	11	7.3	7.2	8.8	7.8	6.4	11	7.7	7.8	7.0
25	15	11	10	7.6	7.1	8.4	8.0	7.0	11	8.1	7.4	7.0
26	13	10	9.4	8.3	7.1	9.0	8.2	7.2	12	8.9	7.2	7.1
27	11	11	10	7.9	7.0	8.9	8.0	6.9	14	8.9	7.0	7.0
28	9.8	10	12	7.3	7.0	11	7.8	6.4	13	8.7	7.0	7.1
29	8.8	9.8	11	7.6	---	14	7.5	7.0	11	8.0	7.0	7.3
30	8.1	9.3	10	8.4	---	12	7.1	10	10	8.3	7.0	7.3
31	7.4	---	8.7	8.1	---	10	---	25	---	8.4	6.9	---
TOTAL	264.5	360.2	273.7	254.8	201.7	294.8	281.9	217.1	407.2	257.9	264.7	272.4
MEAN	8.53	12.0	8.83	8.22	7.20	9.51	9.40	7.00	13.6	8.32	8.54	9.08
MAX	17	20	12	11	7.9	16	11	25	37	9.7	15	14
MIN	4.3	6.4	7.5	7.3	7.0	7.0	7.1	5.4	8.8	6.9	6.9	7.0
CFSM	.46	.64	.47	.44	.39	.51	.50	.37	.73	.45	.46	.49
IN.	.53	.72	.54	.51	.40	.59	.56	.43	.81	.51	.53	.54

CAL YR 1988 TOTAL 2471.5 MEAN 6.75 MAX 24 MIN 1.1 CFSM .36 IN 4.92
WTR YR 1989 TOTAL 3350.9 MEAN 9.18 MAX 37 MIN 4.3 CFSM .49 IN 6.67

04108500 KALAMAZOO RIVER NEAR FENNVILLE, MI

(National stream quality accounting network station)

LOCATION.--Lat 42°35'36", long 85°59'03", in NE1/4 sec.5, T.2 N., R.14 W., Allegan County, Hydrologic Unit 04050003, on left bank 40 ft upstream from bridge on State Highway 89, 2.1 mi downstream from Swan Creek, 4.0 mi downstream from Calkins Dam, and 6.1 mi east of Fennville.

DRAINAGE AREA.--1,600 mi², approximately.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--April 1929 to September 1936, October 1937 to current year. Monthly discharge only for some periods, published in WSP 1307. Published as "near Allegan" April 1929 to September 1932; as "at Calkins Bridge, near Allegan" October 1932 to September 1936, and October 1937 to September 1938; as "at Calkins Dam, near Allegan" October 1938 to September 1950.

REVISED RECORDS.--WSP 1387: 1929(M), 1930, 1933, 1934-36(M), 1938(M), 1939-40, 1942.

GAGE.--Water-stage recorder. Datum of gage is 586.51 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). April 1929 to September 1936 at bridge and October 1937 to September 1950 in powerplant, 4.0 mi upstream at NGVD (levels by City of Allegan).

REMARKS.--No estimated daily discharges. Water-discharge records good. Flow regulated at low and medium stages by powerplants upstream from station and since June 1936 by Calkins Dam and powerplant, 4.0 mi upstream from station.

AVERAGE DISCHARGE.--59 years, 1,451 ft³/s, 12.32 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 17,500 ft³/s, Apr. 11, 1947, gage height, 606.76 ft, site and datum then in use; minimum daily, 50 ft³/s, Aug. 19, 1976, caused by shutting off flow at Calkins Dam.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 7,730 ft³/s, June 1, gage height, 13.33 ft; minimum daily, 819 ft³/s, Aug. 31.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1400	1500	2240	2000	1910	1180	2450	1330	6820	1850	1080	1380
2	1410	1470	2110	1850	2120	1380	2310	1240	7300	1790	1080	1720
3	1470	1730	2090	1850	2300	1580	2710	1710	5970	1710	1340	1590
4	1430	1500	2210	1840	2120	1310	3210	1410	5240	1560	1420	1330
5	1500	1270	1980	1830	1880	1310	2630	1390	5810	1140	1240	1260
6	1610	1860	1890	1790	1770	1310	2690	1360	5680	1200	1590	1600
7	1250	2090	1830	1740	1620	1310	2670	1120	5230	1590	1150	1540
8	1220	2060	1790	1770	1550	1610	2310	1450	4780	1350	1420	1540
9	1220	2380	1870	2090	1460	1910	2410	1490	4220	1320	1580	1560
10	1070	2820	1900	2240	1150	1540	2600	1050	3800	1270	1050	2070
11	1430	4330	1720	2080	1190	1390	2300	1240	3190	1210	1170	2000
12	1390	4150	1520	2140	1500	1810	2220	1370	2850	1120	1500	1740
13	1030	3530	1720	2320	1860	2060	2120	1060	2410	1240	1050	1680
14	963	3120	1560	2260	1920	2090	1970	1200	2640	1220	1060	1420
15	1030	3310	1600	2010	1870	2700	1870	1370	2130	1160	1150	1480
16	1160	3380	1630	1890	1590	3560	1860	1210	2160	1140	1110	1690
17	1270	3290	1670	1900	1580	2810	1850	1380	2170	1120	1100	1540
18	1610	3290	1760	1820	1500	2510	1860	1210	2160	1140	1150	1540
19	1740	2840	1600	1720	1400	3060	1790	1660	1800	1080	1050	1360
20	1850	2710	1630	1740	1400	3330	1730	1460	1810	1290	975	1150
21	1820	3040	1890	1730	1400	3200	1540	1110	1820	1460	1030	1410
22	1890	3140	1850	1720	1400	3120	1750	1400	1770	1050	1300	1370
23	1790	2800	1870	1720	1410	3090	1750	1500	1900	1030	1060	1130
24	1900	2650	1930	1640	1410	2930	1690	1080	2220	1180	1030	1160
25	2140	2690	1960	1650	1430	2620	1640	1460	1770	1500	974	1150
26	2330	2230	1960	1690	1420	2340	1730	1760	1750	1360	1020	1130
27	2320	2580	2120	1690	1210	2290	1590	1640	1670	1280	1060	1090
28	2200	2660	2190	1760	1160	2250	1360	1340	1720	1320	1170	1090
29	1850	2380	2350	1780	---	2390	1600	1400	1860	1400	1430	1060
30	1810	2350	2350	1780	---	2910	1590	1790	1850	1660	940	1090
31	1630	---	2290	1850	---	2810	---	4590	---	1530	819	---
TOTAL	48733	79150	59080	57890	44530	69710	61800	45780	96500	41270	36098	42870
MEAN	1572	2638	1906	1867	1590	2249	2060	1477	3217	1331	1164	1429
MAX	2330	4330	2350	2320	2300	3560	3210	4590	7300	1850	1590	2070
MIN	963	1270	1520	1640	1150	1180	1360	1050	1670	1030	819	1060
CFSM	.98	1.65	1.19	1.17	.99	1.41	1.29	.92	2.01	.83	.73	.89
IN.	1.13	1.84	1.37	1.35	1.04	1.62	1.44	1.06	2.24	.96	.84	1.00

CAL YR 1988 TOTAL 583058 MEAN 1593 MAX 4330 MIN 502 CFSM 1.00 IN 13.56
WTR YR 1989 TOTAL 683411 MEAN 1872 MAX 7300 MIN 819 CFSM 1.17 IN 15.89

04108500 KALAMAZOO RIVER NEAR FENNVILLE, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967, 1972-75, 1987 to current year.

REMARKS.--Bimonthly cross-sectional samples were collected at bridge.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
NOV										
15...	1230	3300	543	8.2	6.5	4.6	11.4	95	>240	>400
JAN										
19...	1215	1710	574	8.4	1.5	3.6	12.7	93	K65	35
MAR										
16...	1300	3690	507	8.3	3.0	20	13.1	99	E160	K1500
MAY										
09...	1200	1720	603	8.8	12.5	6.0	14.3	138	K5	K1
JUN										
06...	1500	5740	397	8.1	21.0	9.4	7.3	84	110	270
SEP										
13...	1130	1680	538	8.4	20.0	9.0	6.7	75	K16	E26

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
NOV										
15...	260	83	70	20	15	11	0.4	2.6	212	0
JAN										
19...	270	68	72	21	21	15	0.6	2.3	232	5
MAR										
16...	250	60	68	20	22	16	0.6	2.3	234	0
MAY										
09...	280	54	75	23	24	15	0.6	2.4	249	--
JUN										
06...	190	44	53	14	9.7	10	0.3	2.4	178	0
SEP										
13...	240	40	63	19	19	15	0.6	0.8	225	7

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)
NOV									
15...	174	62	24	0.2	9.9	322	0.44	2870	<0.01
JAN									
19...	198	56	31	0.1	8.8	356	0.48	1640	0.02
MAR									
16...	192	48	31	0.2	6.8	329	0.45	3280	0.02
MAY									
09...	228	53	34	0.3	2.8	364	0.50	1690	<0.01
JUN									
06...	146	30	15	0.2	8.7	254	0.35	3940	0.04
SEP									
13...	196	40	29	0.2	4.3	317	0.43	1440	0.03

04108500 KALAMAZOO RIVER NEAR PENNVILLE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)
NOV										
15...	1.5	0.08	0.08	1.0	0.05	0.03	0.02	<10	3	54
JAN										
19...	1.6	0.09	0.08	0.70	0.02	0.01	<0.01	--	--	--
MAR										
16...	1.5	0.04	0.06	0.60	0.04	0.01	0.04	10	1	51
MAY										
09...	0.64	0.02	<0.01	0.40	0.05	0.02	<0.01	<10	1	61
JUN										
06...	0.87	0.08	0.08	1.2	0.07	0.03	0.02	<10	1	55
SEP										
13...	0.76	0.16	0.15	1.4	0.12	0.02	0.01	--	--	--

DATE	BERYLLIUM, DISSOLVED (UG/L AS BE)	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)
NOV										
15...	<0.5	<1	<1	<3	2	61	8	11	22	<0.1
JAN										
19...	--	--	--	--	--	--	--	--	--	--
MAR										
16...	<0.5	1	<1	<3	2	24	<5	6	52	<0.1
MAY										
09...	<0.5	4	<1	<3	2	10	1	6	4	<0.1
JUN										
06...	<0.5	<1	<1	<3	2	92	1	5	19	<0.1
SEP										
13...	--	--	--	--	--	--	--	--	--	--

DATE	MOLYBDENUM, DISSOLVED (UG/L AS MO)	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
NOV										
15...	<10	2	<1	1.0	120	<6	3	13	116	88
JAN										
19...	--	--	--	--	--	--	--	8	37	100
MAR										
16...	<10	1	<1	<1.0	120	<6	7	31	309	77
MAY										
09...	<10	3	<1	<1.0	140	<6	4	14	65	88
JUN										
06...	<10	2	<1	<1.0	97	<6	7	28	434	84
SEP										
13...	--	--	--	--	--	--	--	23	104	81

04108600 RABBIT RIVER NEAR HOPKINS, MI

LOCATION.--Lat 42°38'32", long 85°43'19", in SE1/4 sec.16, T.3 N., R.12 W., Allegan County, Hydrologic Unit 04050003, on left bank at downstream side of bridge on 18th Street, 2.5 mi northeast of Hopkins.

DRAINAGE AREA.--71.4 mi².

PERIOD OF RECORD.--October 1965 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 700 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 11-19, Dec. 30 to Jan. 6, Jan. 10-14, 22, Feb. 4 to Mar. 9, May 31, and June 1. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--24 years, 58.0 ft³/s, 11.03 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,860 ft³/s, May 31, 1989, gage height, 9.57 ft, from floodmark; minimum not determined; minimum daily, 9.2 ft³/s, Aug. 27, 28, 1970, Sept. 18, 1971, Aug. 7, 1987; minimum gage height, 1.68 ft, Aug. 8, 1987.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 300 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Nov. 10	2100	303	6.95	May 31	unknown	*1,860	*a9.57
Mar. 15	0900	460	7.60				

a From floodmark.

Minimum daily discharge, 20 ft³/s, Sept. 29, 30; minimum gage height, 2.27 ft, Feb. 17, result of freezeup.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	30	47	71	57	67	32	83	39	1150	38	28	34
2	38	45	67	53	58	32	75	38	563	36	25	38
3	42	44	67	51	52	34	85	39	324	35	24	32
4	41	45	64	50	48	37	92	38	242	34	35	29
5	42	72	60	49	47	40	90	38	181	33	95	27
6	38	132	59	49	45	47	81	37	135	32	93	27
7	34	190	57	52	44	46	73	35	105	31	57	38
8	32	160	53	147	43	45	67	35	88	29	44	40
9	31	124	51	104	42	47	62	35	78	29	37	54
10	30	250	49	86	41	47	58	34	72	29	33	54
11	30	260	47	75	40	71	56	33	65	27	31	42
12	29	200	46	67	40	138	60	33	60	27	41	36
13	27	200	45	61	39	126	71	34	61	26	34	32
14	26	162	45	58	39	169	67	33	59	32	33	34
15	26	119	47	56	38	395	96	33	57	28	41	33
16	28	151	45	54	37	285	76	33	55	26	46	30
17	43	146	44	52	37	191	69	32	53	25	36	29
18	57	106	43	52	36	167	65	31	49	24	31	27
19	53	100	41	55	35	150	60	32	48	25	29	25
20	51	113	65	60	35	147	56	36	50	30	32	25
21	49	107	88	52	34	133	55	34	48	31	35	24
22	53	91	67	50	34	105	53	32	53	29	33	24
23	53	81	122	49	33	99	49	30	69	31	55	23
24	96	75	101	50	33	96	46	29	92	27	53	23
25	121	70	78	53	33	93	47	55	75	26	41	22
26	90	67	64	64	33	86	47	62	57	29	35	22
27	76	95	68	61	32	80	45	44	51	29	32	21
28	67	90	106	56	32	104	43	37	49	35	30	21
29	59	78	85	59	---	191	42	34	43	28	31	20
30	53	72	72	78	---	133	41	135	40	29	30	20
31	49	---	65	72	---	99	---	1530	---	32	28	---
TOTAL	1494	3492	1982	1932	1127	3465	1910	2720	4072	922	1228	906
MEAN	48.2	116	63.9	62.3	40.3	112	63.7	87.7	136	29.7	39.6	30.2
MAX	121	260	122	147	67	395	96	1530	1150	38	95	54
MIN	26	44	41	49	32	32	41	29	40	24	24	20
CFSM	.68	1.63	.90	.87	.56	1.57	.89	1.23	1.91	.42	.56	.42
IN.	.78	1.82	1.03	1.01	.59	1.81	1.00	1.42	2.12	.48	.64	.47

CAL YR 1988 TOTAL 21357 MEAN 58.4 MAX 300 MIN 10 CFSM .82 IN 11.13
WTR YR 1989 TOTAL 25250 MEAN 69.2 MAX 1530 MIN 20 CFSM .97 IN 13.16

04108800 MACATAWA RIVER NEAR ZEELAND, MI

LOCATION.--Lat 42°46'40", long 86°01'06", in NW1/4 sec.31, T.5 N., R.14 W., Ottawa County, Hydrologic Unit 04050002, on left bank 20 ft upstream from bridge on State Road, 0.2 mi downstream from South Branch, and 2.5 mi south of Zeeland.

DRAINAGE AREA.--65.8 mi².

PERIOD OF RECORD.--October 1960 to current year. Prior to October 1978, published as Black River near Zeeland.

GAGE.--Water-stage recorder. Datum of gage is 585.7 ft above National Geodetic Vertical Datum of 1929 (levels by Gove Associates, Inc.).

REMARKS.--Estimated daily discharges: Dec. 11-19, Dec. 29 to Jan. 15, Jan. 20, 21, and Feb. 3 to Mar. 10. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--29 years, 68.2 ft³/s, 14.08 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,220 ft³/s, May 11, 1981, gage height, 15.81 ft; minimum, 0.83 ft³/s, Aug. 3, 1988; minimum gage height, 1.61 ft, Sept. 3, 1983.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 900 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Mar. 15	1000	1,420	11.15	May 31	0800	*4,150	*14.29

Minimum discharge, 3.5 ft³/s, July 16, 17; minimum gage height, 1.88 ft, July 7, 8, 9, 15, 16, 17, Sept. 5, 6.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	7.6	31	108	35	137	15	41	16	2050	9.8	4.5	12
2	10	30	115	33	58	15	36	17	886	8.3	4.5	10
3	11	29	176	32	35	16	45	17	469	11	4.8	7.4
4	11	31	86	30	30	20	64	16	331	8.5	119	6.7
5	13	230	54	29	27	25	65	16	115	7.7	371	6.4
6	11	510	49	28	24	30	40	16	63	6.8	243	14
7	9.0	683	43	32	22	25	33	15	47	6.0	82	28
8	8.0	397	36	130	21	23	29	15	38	5.7	25	144
9	7.7	188	32	60	20	21	26	15	33	6.0	18	91
10	7.8	685	30	40	19	33	24	14	29	5.9	14	29
11	9.4	627	29	35	19	156	23	14	25	5.9	12	17
12	9.3	323	28	33	19	397	26	14	24	5.5	10	14
13	9.5	554	26	32	19	288	28	16	25	5.3	9.2	13
14	9.7	305	28	31	19	355	44	15	24	4.9	8.5	14
15	11	125	33	30	19	1160	80	16	23	4.3	8.3	12
16	12	310	33	29	18	577	36	15	21	3.9	7.8	10
17	21	224	32	29	18	253	33	14	20	4.1	7.0	9.2
18	35	88	32	34	18	128	30	14	19	4.2	6.3	8.3
19	35	106	31	52	18	173	25	15	18	5.9	5.8	7.7
20	34	141	412	65	17	224	23	17	18	11	8.3	6.7
21	26	82	585	37	17	162	23	15	16	6.7	7.9	6.2
22	71	57	170	31	17	109	21	13	15	6.7	8.8	5.8
23	88	47	468	29	16	127	19	12	15	9.7	26	5.8
24	332	42	240	34	16	133	18	11	19	5.8	11	5.5
25	391	38	96	41	16	127	20	65	13	5.2	7.9	5.5
26	184	39	55	168	15	84	22	46	15	4.7	6.8	5.2
27	97	397	158	78	15	61	20	22	40	5.8	6.2	4.8
28	77	220	389	53	15	150	18	17	18	7.5	6.5	4.8
29	57	163	110	117	---	333	18	15	13	4.9	8.3	4.8
30	39	112	60	257	---	92	17	294	12	5.5	7.1	4.7
31	33	---	41	153	---	55	---	3140	---	5.5	6.5	---
TOTAL	1677.0	6814	3785	1817	704	5367	947	3957	4454	198.7	1072.0	513.5
MEAN	54.1	227	122	58.6	25.1	173	31.6	128	148	6.41	34.6	17.1
MAX	391	685	585	257	137	1160	80	3140	2050	11	371	144
MIN	7.6	29	26	28	15	15	17	11	12	3.9	4.5	4.7
CFSM	.82	3.45	1.85	.89	.38	2.63	.48	1.95	2.25	.10	.53	.26
IN.	.95	3.85	2.14	1.03	.40	3.03	.54	2.24	2.52	.11	.61	.29

CAL YR 1988 TOTAL 28633.6 MEAN 78.2 MAX 923 MIN 1.3 CFSM 1.19 IN 16.19
WTR YR 1989 TOTAL 31306.2 MEAN 85.8 MAX 3140 MIN 3.9 CFSM 1.30 IN 17.70

04109000 GRAND RIVER AT JACKSON, MI

LOCATION.--Lat 42°17'05", long 84°24'30", in sec.22, T.2 S., R.1 W., Jackson County, Hydrologic Unit 04050004, on left bank on grounds of sewage-treatment plant, 1 mi north of Jackson, 2.2 mi upstream from Portage River, and at mile 216.

DRAINAGE AREA.--174 mi².

PERIOD OF RECORD.--April 1935 to current year.

REVISED RECORDS.--WSP 974: 1937(M). WSP 1387: 1936. WSP 1727: 1950(M).

GAGE.--Water-stage recorder. Datum of gage is 900.00 ft, Fargo Engineering Co. datum. Prior to Sept. 24, 1935, nonrecording gage at same site and datum.

REMARKS.--No estimated daily discharges. Records good. Slight regulation by mills upstream from station. Flow includes about 20 ft³/s as sewage effluent, which originates from ground-water sources, from the City of Jackson. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--54 years, 123 ft³/s, 9.60 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,070 ft³/s, June 25, 1937, gage height, 13.50 ft; maximum gage height, 15.44 ft, June 25, 1968; minimum discharge, 9.2 ft³/s, Aug. 22, 1936.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 728 ft³/s, June 3, gage height, 13.12 ft; minimum, 48 ft³/s, Mar. 2, gage height, 8.55 ft, result of regulation.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	122	87	182	153	176	81	227	152	353	173	149	118
2	137	85	165	150	177	78	229	124	416	161	140	92
3	127	82	175	151	174	89	274	114	531	153	138	89
4	122	123	171	143	167	156	314	110	551	120	172	83
5	116	159	169	141	159	148	318	108	569	106	164	86
6	86	154	167	146	154	132	328	105	566	101	144	98
7	73	155	165	165	145	131	329	100	551	96	142	130
8	69	157	160	206	102	136	340	102	523	91	138	153
9	67	171	157	155	99	136	327	103	487	85	135	142
10	68	241	152	156	104	133	312	103	421	82	132	135
11	69	216	128	184	99	123	288	100	351	85	129	132
12	69	221	134	189	93	123	219	102	322	81	123	130
13	64	230	146	180	96	127	175	116	298	80	117	132
14	62	221	145	167	100	135	166	112	278	82	112	133
15	57	224	142	169	134	150	192	117	249	74	110	99
16	65	332	122	163	140	153	199	146	223	70	91	101
17	126	298	136	160	136	161	199	151	225	72	86	99
18	148	295	130	159	133	213	196	148	223	73	83	98
19	151	283	128	134	132	190	191	153	246	75	80	101
20	145	311	102	124	134	193	188	152	243	97	89	125
21	145	305	97	111	138	190	188	146	309	80	81	130
22	142	298	101	117	131	187	181	140	283	86	78	130
23	146	286	160	118	85	207	175	102	237	84	77	140
24	151	261	149	117	81	217	174	93	209	89	76	130
25	154	241	145	129	86	215	179	155	196	146	75	126
26	113	247	142	136	81	207	173	130	229	172	72	90
27	98	261	183	143	84	206	168	153	218	188	70	79
28	99	241	173	143	84	219	161	155	200	182	77	75
29	93	204	158	149	---	233	158	151	191	178	76	71
30	87	176	152	157	---	234	153	206	182	184	73	67
31	88	---	161	176	---	234	---	299	---	179	72	---
TOTAL	3259	6565	4597	4691	3424	5137	6721	4148	9880	3525	3301	3314
MEAN	105	219	148	151	122	166	224	134	329	114	106	110
MAX	154	332	183	206	177	234	340	299	569	188	172	153
MIN	57	82	97	111	81	78	153	93	182	70	70	67
CFSM	.60	1.26	.85	.87	.70	.95	1.29	.77	1.89	.66	.61	.63
IN.	.70	1.40	.98	1.00	.73	1.10	1.44	.89	2.11	.75	.71	.71

CAL YR 1988 TOTAL 43141 MEAN 118 MAX 332 MIN 27 CFSM .68 IN 9.22
WTR YR 1989 TOTAL 58562 MEAN 160 MAX 569 MIN 57 CFSM .92 IN 12.52

04111379 RED CEDAR RIVER NEAR WILLIAMSTON, MI

LOCATION.--Lat 42°40'59", long 84°13'09", in NE1/4 sec.4, T.3 N., R.2 E., Ingham County, Hydrologic Unit 04050004, on right bank 20 ft upstream from bridge on State Highway 52, 1.5 mi upstream from Squaw Creek, and 3.5 mi east of Williamston.

DRAINAGE AREA.--163 mi^2.

PERIOD OF RECORD.--July 1975 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 870 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 11-13, 16-19, 29-31, Jan. 3-15, 21-22, Feb. 4-19, 23-25, and Mar. 1-8, 19. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--14 years, 105 ft^3/s, 8.75 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,790 ft^3/s, Feb. 26, 1985, gage height, 9.07 ft; minimum, 2.2 ft^3/s, July 13, 14, 1988, gage height, 1.94 ft.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of April 1975, reached a stage of 10.41 ft, Apr. 19, and a discharge of 2,640 ft^3/s, Apr. 20.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 649 ft^3/s, June 4, gage height, 6.61 ft; minimum, 17 ft^3/s, Oct. 16; minimum gage height, 2.29 ft, Aug. 10.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	24	56	208	153	149	50	277	87	577	239	26	28
2	26	54	189	119	149	45	252	84	603	204	23	33
3	29	52	173	90	128	48	245	82	581	172	23	32
4	28	52	157	72	80	60	282	78	637	135	24	28
5	26	66	145	80	66	120	328	74	603	106	27	25
6	24	132	136	94	64	160	337	70	544	92	26	57
7	22	179	129	90	62	120	335	68	480	84	25	187
8	21	192	122	240	62	95	315	65	409	72	24	231
9	22	197	114	250	62	80	293	63	340	65	22	361
10	22	266	104	210	62	71	269	61	262	58	20	349
11	22	357	64	220	62	77	244	58	230	50	21	282
12	23	345	66	210	62	89	223	57	185	47	22	217
13	22	332	80	160	62	87	210	66	152	44	22	141
14	20	321	90	120	62	87	195	72	132	42	22	111
15	18	299	82	110	63	141	185	70	147	39	25	99
16	18	320	62	108	66	174	177	67	158	36	26	90
17	22	449	65	97	64	158	167	62	152	33	24	112
18	55	479	68	93	60	202	160	58	141	33	22	121
19	76	449	68	99	58	180	157	56	141	32	20	105
20	76	417	70	101	57	321	145	59	206	37	22	87
21	71	404	81	80	57	343	138	61	228	40	23	75
22	67	373	81	76	56	325	135	57	258	38	29	66
23	62	337	99	86	50	297	126	52	275	36	40	60
24	68	306	125	83	50	270	119	48	262	33	32	55
25	80	276	129	83	51	247	115	97	229	31	27	52
26	86	250	117	88	53	235	111	129	194	29	24	48
27	83	254	115	96	52	231	107	122	235	27	22	45
28	77	265	191	95	55	237	101	101	276	28	24	42
29	70	244	180	98	---	286	97	80	268	28	35	40
30	64	226	150	116	---	303	92	84	263	27	31	36
31	58	---	140	134	---	295	---	325	---	27	27	---
TOTAL	1382	7949	3600	3751	1924	5434	5937	2513	9188	1964	780	3215
MEAN	44.6	265	116	121	68.7	175	198	81.1	306	63.4	25.2	107
MAX	86	479	208	250	149	343	337	325	637	239	40	361
MIN	18	52	62	72	50	45	92	48	132	27	20	25
CFSM	.27	1.63	.71	.74	.42	1.07	1.22	.50	1.88	.39	.16	.66
IN.	.32	1.81	.82	.86	.44	1.24	1.35	.57	2.10	.45	.18	.73

CAL YR 1988 TOTAL 36678.6 MEAN 100 MAX 479 MIN 4.4 CFSM .61 IN 8.37
WTR YR 1989 TOTAL 47637.0 MEAN 131 MAX 637 MIN 18 CFSM .80 IN 10.87

04111500 DEER CREEK NEAR DANSVILLE, MI

LOCATION.--Lat 42°36'30", long 84°19'15", in E1/2 sec.33, T.3 N., R.1 E., Ingham County, Hydrologic Unit 04050004, on right bank 15 ft upstream from bridge on Clark Road, 3.5 mi north of Dansville, and 7.2 mi upstream from mouth.

DRAINAGE AREA.--16.3 mi^{2}.

PERIOD OF RECORD.--May 1954 to current year.

REVISED RECORDS.--WSP 1727: 1954(M).

GAGE.--Water-stage recorder and concrete control. Datum of gage is 889.08 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources).

REMARKS.--Estimated daily discharges: Nov. 11 to Dec. 5, Dec. 26, 30, Jan. 14, Feb. 3-19, and Mar. 18, 19. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--35 years, 10.9 ft^{3}/s, 9.08 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 962 ft^{3}/s, Apr. 19, 1975, gage height, 12.18 ft, from floodmark, from rating curve extended above 610 ft^{3}/s; minimum, 0.04 ft^{3}/s, Sept. 8, 9, 12, 1978, gage height, 2.58 ft.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 100 ft^{3}/s and maximum (*):

Date	Time	Discharge (ft^{3}/s)	Gage height (ft)	Date	Time	Discharge (ft^{3}/s)	Gage height (ft)
Nov. 10	1300	166	5.63	May 31	1400	*248	*6.97
Jan. 8	0600	107	4.66				

Minimum discharge, 1.0 ft^{3}/s, Feb. 28, gage height, 2.77 ft, result of freezeup.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.9	6.8	16	10	20	3.6	21	7.1	186	7.6	1.5	2.3
2	3.6	6.3	15	9.3	16	3.9	20	7.0	107	6.2	1.4	2.8
3	4.1	5.9	14	8.7	12	3.8	35	6.7	64	5.5	1.3	2.1
4	3.8	5.9	13	7.4	8.5	12	61	6.3	84	4.9	1.4	1.7
5	3.3	12	13	7.5	7.5	42	49	6.3	44	4.4	2.5	1.6
6	2.9	44	12	7.5	6.6	14	31	6.1	27	3.9	2.5	3.3
7	2.7	39	12	10	6.2	8.7	24	6.0	20	3.6	1.8	6.2
8	2.6	28	11	88	5.8	6.9	21	5.7	17	3.3	1.6	11
9	2.7	24	9.7	47	5.7	6.7	21	5.7	14	3.0	1.5	22
10	2.8	128	9.4	27	5.5	8.3	20	5.5	11	2.7	1.4	15
11	2.7	75	8.2	14	5.3	11	18	4.9	9.2	2.5	1.9	9.2
12	2.5	48	7.2	14	5.2	13	17	5.3	8.6	2.4	5.2	6.6
13	2.4	43	7.5	13	5.2	10	18	7.5	9.4	2.4	4.1	5.2
14	2.4	38	7.7	10	5.2	12	16	7.0	9.3	2.1	2.8	5.4
15	2.3	27	6.8	9.1	5.2	44	17	6.3	16	2.1	3.6	5.2
16	2.2	45	7.0	8.1	5.1	23	16	6.0	14	2.0	3.4	5.1
17	3.1	43	6.2	7.8	5.1	20	15	5.5	11	1.8	2.4	8.0
18	19	25	6.1	8.0	5.0	60	14	5.0	9.1	1.7	1.9	6.9
19	17	20	6.1	9.4	5.0	50	13	5.7	9.6	1.7	1.7	5.6
20	12	27	7.2	9.0	4.8	43	12	8.0	16	2.3	2.0	4.7
21	9.2	45	9.2	7.9	4.9	33	13	7.4	12	2.4	2.2	4.2
22	9.0	28	8.1	7.1	4.6	26	12	6.0	13	2.1	2.0	3.7
23	8.4	20	16	6.7	4.2	24	11	5.3	14	1.9	2.1	3.4
24	13	17	16	6.9	4.6	25	9.6	4.7	10	1.7	1.9	3.1
25	18	15	14	7.3	4.4	28	9.7	17	7.9	1.6	1.6	2.9
26	16	14	11	9.9	4.5	28	9.8	17	8.4	1.6	1.4	2.6
27	13	45	15	9.9	4.4	27	9.3	11	24	1.8	1.2	2.4
28	11	33	41	9.2	4.1	34	8.7	8.0	22	2.6	1.5	2.4
29	8.7	21	23	11	---	66	8.2	6.7	13	1.9	2.4	2.2
30	7.6	18	18	17	---	40	7.7	8.6	9.7	1.7	1.9	2.0
31	6.9	---	12	17	---	28	---	188	---	1.7	1.6	---
TOTAL	217.8	946.9	378.4	434.7	180.6	754.9	558.0	403.3	820.2	87.1	65.7	158.8
MEAN	7.03	31.6	12.2	14.0	6.45	24.4	18.6	13.0	27.3	2.81	2.12	5.29
MAX	19	128	41	88	20	66	61	188	186	7.6	5.2	22
MIN	2.2	5.9	6.1	6.7	4.1	3.6	7.7	4.7	7.9	1.6	1.2	1.6
CFSM	.43	1.94	.75	.86	.40	1.50	1.14	.80	1.68	.17	.13	.33
IN.	.50	2.16	.86	.99	.41	1.72	1.27	.92	1.87	.20	.15	.36

CAL YR 1988 TOTAL 4188.94 MEAN 11.4 MAX 145 MIN .24 CFSM .70 IN 9.56
WTR YR 1989 TOTAL 5006.40 MEAN 13.7 MAX 188 MIN 1.2 CFSM .84 IN 11.42

04112000 SLOAN CREEK NEAR WILLIAMSTON, MI

LOCATION.--Lat 42°40'33", long 84°21'50", in SE1/4 NE1/4 sec.1, T.3 N., R.1 W., Ingham County, Hydrologic Unit 04050004, on left bank 30 ft downstream from culvert on Meridian Road, 2.1 mi upstream from mouth, and 4.2 mi west of Williamston.

DRAINAGE AREA.--9.34 mi^2.

PERIOD OF RECORD.--June 1954 to current year.

GAGE.--Water-stage recorder and concrete control with V-notch sharp-crested weir. Datum of gage is 862.12 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources).

REMARKS.--Estimated daily discharges: Feb. 14-16, July 12-28, and Aug. 9-11. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--35 years, 5.71 ft^3/s, 8.30 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,290 ft^3/s, Apr. 18, 1975, gage height, 9.99 ft, from rating curve extended above 660 ft^3/s on basis of computation of peak flow through culvert and over road embankment; minimum, 0.01 ft^3/s, Sept. 11, 1954, Jan. 18, 1957, Aug. 3, 1988; minimum gage height, 1.10 ft, Sept. 11, 1954, Jan. 18, 1957.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 120 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
May 31	0900	*364	*5.48	No other peak greater than base discharge.			

Minimum discharge, 0.14 ft^3/s, Oct. 1, 2, 6, 8, Aug. 3, 4, gage height, 1.33 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.14	1.3	5.7	3.5	6.9	.90	8.5	2.5	72	1.3	.20	.99
2	.18	1.2	5.1	3.1	4.9	.82	7.3	2.4	43	1.2	.18	1.1
3	.17	1.1	4.8	2.7	3.5	.86	17	2.3	32	1.1	.17	1.0
4	.18	1.1	4.4	2.3	2.8	6.2	31	2.2	36	.95	.21	.93
5	.16	4.0	4.2	2.2	2.6	18	24	2.2	23	.88	.30	.89
6	.14	18	4.0	2.2	2.4	6.5	15	1.9	16	.85	.25	1.3
7	.15	16	3.7	6.1	2.2	3.5	11	1.8	10	.75	.21	3.0
8	.14	12	3.2	34	1.9	2.7	8.8	1.8	7.5	.66	.19	8.6
9	.18	9.2	3.0	12	1.6	3.0	9.0	1.7	5.8	.61	.17	21
10	.18	50	2.8	6.1	1.5	4.4	8.8	1.6	4.6	.53	.16	8.8
11	.18	29	2.4	4.3	1.6	5.4	8.1	1.4	3.9	.48	.18	4.9
12	.20	19	2.1	4.2	1.5	5.5	8.3	1.5	3.6	.43	.21	3.4
13	.23	18	2.2	3.4	1.5	4.0	10	1.9	3.7	.38	.26	2.7
14	.21	13	2.3	2.8	1.5	4.1	8.4	1.8	3.4	.34	.20	2.5
15	.22	8.8	2.1	2.7	1.4	15	11	1.7	4.4	.30	.44	2.1
16	.22	18	1.7	2.3	1.4	7.6	9.3	1.5	4.1	.27	1.2	1.9
17	.34	17	1.7	2.2	1.4	6.5	7.9	1.4	3.4	.24	.67	2.2
18	2.9	9.8	1.7	2.2	1.3	26	7.2	1.3	2.8	.23	.39	1.9
19	2.6	7.9	1.7	2.5	1.4	19	6.2	1.5	4.8	.25	.29	1.5
20	1.8	11	2.0	2.4	1.4	16	5.3	2.0	5.2	.32	.43	1.3
21	1.5	18	2.0	1.9	1.4	13	5.1	1.8	3.9	.30	.45	1.1
22	1.4	11	1.8	1.8	1.2	10	4.9	1.6	3.9	.27	.44	.97
23	1.4	8.1	3.4	1.8	1.0	10	4.4	1.4	3.7	.24	.94	.81
24	3.0	6.7	4.2	1.8	.89	12	3.9	1.3	2.9	.22	.74	.73
25	4.3	5.8	3.6	1.8	1.1	15	3.8	21	2.4	.21	.45	.69
26	3.7	5.5	2.9	2.3	1.2	14	3.7	15	2.2	.23	.30	.67
27	2.8	18	6.5	2.4	1.1	13	3.5	7.0	2.7	.28	.26	.60
28	2.3	13	15	2.2	.99	16	3.2	4.5	2.4	.32	.43	.55
29	1.8	8.0	7.4	2.6	---	28	3.0	3.5	1.8	.23	.97	.61
30	1.5	6.7	5.2	4.9	---	17	2.7	6.7	1.5	.23	.92	.65
31	1.3	---	4.1	5.1	---	12	---	172	---	.23	.83	---
TOTAL	35.52	366.2	116.9	131.8	53.58	315.98	260.3	272.2	316.6	14.83	13.04	79.39
MEAN	1.15	12.2	3.77	4.25	1.91	10.2	8.68	8.78	10.6	.48	.42	2.65
MAX	4.3	50	15	34	6.9	28	31	172	72	1.3	1.2	21
MIN	.14	1.1	1.7	1.8	.89	.82	2.7	1.3	1.5	.21	.16	.55
CFSM	.12	1.31	.40	.46	.20	1.09	.93	.94	1.14	.05	.05	.28
IN.	.14	1.46	.47	.52	.21	1.26	1.04	1.08	1.26	.06	.05	.32

CAL YR 1988 TOTAL 1661.70 MEAN 4.54 MAX 78 MIN .02 CFSM .49 IN 6.62
WTR YR 1989 TOTAL 1976.34 MEAN 5.41 MAX 172 MIN .14 CFSM .58 IN 7.87

04112500 RED CEDAR RIVER AT EAST LANSING, MI

LOCATION.--Lat 42°43'40", long 84°28'40", in SW1/4 sec.18, T.4 N., R.1 W., Ingham County, Hydrologic Unit 04050004, in left downstream bridge abutment of Farm Lane Bridge on Michigan State University Campus in East Lansing, 4.0 mi upstream from Sycamore Creek, and 5.6 mi upstream from mouth.

DRAINAGE AREA.--355 mi^2.

PERIOD OF RECORD.--August 1902 to December 1903, March 1931 to current year. Monthly discharge only for some periods, published in WSP 1307. Published as Red Cedar River at Agricultural College, August 1902 to December 1903 and as Cedar River at East Lansing, March 1931 to September 1965. Gage-height records collected in this vicinity 1911-19, and 1920-28 (flood seasons only), are contained in reports of the National Weather Service.

REVISED RECORDS.--WSP 1307: 1936(M).

GAGE.--Water-stage recorder and concrete control. Datum of gage is 824.39 ft above National Geodetic Vertical Datum of 1929. August 1902 to December 1903 nonrecording gage at site 0.8 mi downstream at different datum. March 1931 to November 1940 water-stage recorder at site 250 ft upstream at present datum.

REMARKS.--Estimated daily discharges: Jan. 7, 8, Feb. 5-12, and Mar. 20. Records good. Prior to April 1975, occasional regulation at low flow by mill at Williamston, 16 mi upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--59 years, 208 ft^3/s, 7.96 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,940 ft^3/s, Apr. 20, 1975, gage height, 11.95 ft; minimum, 3 ft^3/s, July 31, 1931.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Mar. 24, 1904, reached a stage of 13.4 ft, discharge, 8,000 ft^3/s.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,720 ft^3/s, June 1, gage height, 6.66 ft; minimum, 42 ft^3/s, Aug. 3, 4, 19, 28, gage height, 3.22 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	55	113	343	270	267	93	529	172	1640	327	52	81
2	72	110	306	223	282	80	469	165	1670	293	49	70
3	59	107	274	162	240	88	469	162	1440	274	45	68
4	57	104	251	128	159	104	572	156	1280	257	57	61
5	55	140	230	134	125	223	676	150	1180	212	113	55
6	53	244	217	168	120	310	686	146	1030	178	63	66
7	50	364	210	170	115	240	636	140	859	161	61	230
8	48	385	200	415	115	194	567	134	691	143	56	423
9	59	381	184	496	115	168	520	131	554	125	54	611
10	55	527	172	402	115	159	478	125	465	110	60	645
11	53	691	104	433	115	178	442	119	384	98	76	538
12	50	732	107	415	115	207	411	122	328	89	84	389
13	50	686	137	314	113	207	402	140	300	84	55	294
14	48	601	146	223	116	200	376	143	273	81	56	225
15	48	520	137	207	122	318	355	143	305	76	67	197
16	55	478	104	230	128	389	347	140	327	72	60	189
17	74	567	107	191	122	347	330	134	300	67	57	202
18	102	727	116	178	113	411	306	131	272	62	50	222
19	150	789	110	181	110	339	290	137	276	64	45	208
20	156	752	116	194	116	640	278	146	381	81	66	182
21	150	701	128	162	113	636	267	143	417	79	55	159
22	137	656	134	143	110	572	259	134	455	81	61	144
23	134	586	159	181	96	520	244	122	442	72	71	127
24	143	501	194	159	93	496	227	113	403	65	73	113
25	162	433	210	159	96	483	223	330	353	60	59	106
26	178	381	191	168	96	483	217	451	312	58	51	101
27	175	402	227	178	99	469	207	310	371	56	46	95
28	159	451	306	181	99	501	197	233	449	54	90	88
29	146	443	347	181	---	606	188	191	416	57	99	84
30	134	394	270	207	---	650	178	223	358	55	81	80
31	122	---	251	240	---	611	---	1030	---	53	65	---
TOTAL	2989	13966	5988	7093	3625	10922	11346	6116	17931	3544	1977	6053
MEAN	96.4	466	193	229	129	352	378	197	598	114	63.8	202
MAX	178	789	347	496	282	650	686	1030	1670	327	113	645
MIN	48	104	104	128	93	80	178	113	272	53	45	55
CFSM	.27	1.31	.54	.65	.36	.99	1.07	.56	1.69	.32	.18	.57
IN.	.31	1.46	.63	.74	.38	1.14	1.19	.64	1.88	.37	.21	.63

CAL YR 1988 TOTAL 71231 MEAN 195 MAX 1180 MIN 12 CFSM .55 IN 7.46
WTR YR 1989 TOTAL 91550 MEAN 251 MAX 1670 MIN 45 CFSM .71 IN 9.59

04112850 SYCAMORE CREEK NEAR HOLT, MI

LOCATION.--Lat 42°38'25", long 84°28'58", in SW1/4 SW1/4 sec.18, T.3 N., R.1 W., Ingham County, Hydrologic Unit 04050004, on left bank 15 ft downstream from bridge on Holt Road, 1.5 mi east of Holt.

DRAINAGE AREA.--80.6 mi^2.

PERIOD OF RECORD.--April 1975 to September 1980, May to September 1989.

GAGE.--Water-stage recorder. Elevation of gage is 850 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--No estimated daily discharges. Records good.

AVERAGE DISCHARGE.--5 years (water years 1976-80), 47.8 ft^3/s, 8.05 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,110 ft^3/s, Apr. 19, 1975, gage height, 10.00 ft; minimum, 3.8 ft^3/s, Sept. 29, Oct. 1, 1979.

EXTREMES FOR CURRENT YEAR.--Maximum discharge during period May to September, 686 ft^3/s, June 1, gage height, 7.78 ft; minimum, 16 ft^3/s, Aug. 3, 4, gage height, 2.11 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1								40	658	49	18	39
2								39	523	42	17	43
3								38	376	40	16	32
4								37	316	36	20	28
5								36	246	32	58	25
6								35	171	30	59	36
7								33	123	28	34	84
8								32	96	26	27	115
9								32	85	24	24	198
10								31	72	23	22	167
11								29	60	22	28	109
12								30	55	22	70	76
13								41	60	22	52	61
14								39	57	21	35	57
15								36	69	22	57	53
16								34	68	20	53	49
17								31	60	19	38	67
18								29	53	19	30	59
19								34	52	19	26	48
20								47	70	22	30	40
21								44	60	23	29	37
22								37	72	21	29	33
23								33	103	20	30	32
24								30	77	19	27	29
25								64	59	18	24	26
26								90	50	20	22	26
27								62	75	24	20	26
28								45	126	24	27	25
29								39	97	20	55	23
30								45	61	19	36	22
31								374	---	19	29	---
TOTAL								1566	4050	765	1042	1665
MEAN								50.5	135	24.7	33.6	55.5
MAX								374	658	49	70	198
MIN								29	50	18	16	22
CFSM								.63	1.68	.31	.42	.69
IN.								.72	1.87	.35	.48	.77

04113000 GRAND RIVER AT LANSING, MI

LOCATION.--Lat 42°45'02", long 84°33'19", in NW1/4 sec.9, T.4 N., R.2 W., Ingham County, Hydrologic Unit 04050004, on right bank 30 ft upstream from bridge on North Grand River Avenue in Lansing, 2.0 mi downstream from Red Cedar River, and at mile 152.

DRAINAGE AREA.--1,230 mi^2, approximately.

PERIOD OF RECORD.--March 1901 to September 1906, October 1934 to current year. Monthly discharge only for some periods, published in WSP 1307. Published as "at North Lansing" 1901-6. Gage-height records collected in this vicinity 1907-10 (flood seasons only), 1911-19, 1920-28 (flood seasons only), and since 1931 are contained in reports of the National Weather Service.

REVISED RECORDS.--WSP 1174: 1949. WSP 1387: 1901, 1903-4, 1935, 1937, 1942.

GAGE.--Water-stage recorder. Datum of gage is 805.53 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to August 1906, nonrecording gage at same site at different datum. November 1934 to June 1949 water-stage recorder at site 1.8 mi downstream at datum 2.42 ft lower.

REMARKS.--No estimated daily discharges. Records good. Large diurnal fluctuation at low and medium flow caused by powerplants upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--60 years, 843 ft^3/s, 9.31 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 24,500 ft^3/s, Mar. 26, 1904, gage height, 18.60 ft, datum then in use, from rating curve extended above 15,000 ft^3/s; minimum, 2.8 ft^3/s, Sept. 9, 1963, gage height, 0.85 ft; minimum daily, 20 ft^3/s, Aug. 25, 1941.

EXTREMES OUTSIDE PERIOD OF RECORD.--Maximum discharge since at least 1901, that of Mar. 26, 1904.

EXTREMES FOR CURRENT YEAR Maximum discharge, 4,650 ft^3/s, June 2, gage height, 9.39 ft; minimum daily, 234 ft^3/s, Oct. 10, 16.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	390	600	1630	1130	1100	460	1990	828	4410	1410	481	467
2	627	560	1550	1180	1280	426	1690	850	4540	1260	508	368
3	411	538	1370	896	1120	471	1880	796	4440	1180	429	407
4	440	537	1360	818	895	488	2000	799	4170	1040	490	421
5	519	785	1230	702	781	767	2350	737	3710	956	1190	336
6	325	972	1240	782	798	1000	2440	714	3290	824	831	385
7	364	1280	1150	994	769	849	2360	692	2930	783	594	611
8	297	1350	1130	1610	737	764	2220	622	2450	717	645	1200
9	444	1450	1090	1460	707	786	2000	615	2190	690	523	1780
10	234	2210	983	1300	733	838	1980	608	1840	631	493	1590
11	247	2390	785	1490	671	819	1800	581	1680	538	475	1320
12	318	2450	625	1510	666	915	1740	608	1580	517	461	1070
13	272	2440	723	1450	724	946	1670	657	1490	511	531	914
14	294	2270	922	1150	660	957	1590	647	1320	432	439	768
15	270	2060	940	1010	664	1440	1550	691	1530	401	480	721
16	234	1930	822	1070	631	1490	1460	633	1380	400	428	753
17	454	1940	752	1000	615	1440	1380	631	1270	377	416	749
18	478	2290	660	956	609	1770	1390	602	1200	333	362	746
19	681	2540	646	888	626	2200	1290	648	1250	411	353	687
20	768	2630	761	941	630	2400	1280	716	1260	344	465	598
21	743	2450	855	808	604	2510	1180	770	1210	405	349	616
22	803	2300	666	822	558	2090	1220	689	1400	440	357	560
23	743	2220	852	759	532	1920	1110	683	1460	482	350	531
24	859	2020	892	791	544	1730	1110	657	1370	409	360	468
25	875	1850	999	732	471	1790	984	943	1360	363	313	502
26	770	1790	893	823	528	1710	1020	1090	1220	408	258	456
27	881	1760	1010	801	550	1730	999	1010	1450	434	313	451
28	798	1830	1170	877	460	1870	967	876	1690	460	437	442
29	825	1810	1200	823	---	2140	951	822	1640	481	607	364
30	690	1750	1030	968	---	2300	900	970	1670	473	431	362
31	638	---	1040	1050	---	2080	---	3370	---	501	349	---
TOTAL	16692	53002	30976	31591	19663	43096	46501	25555	62400	18611	14718	20643
MEAN	538	1767	999	1019	702	1390	1550	824	2080	600	475	688
MAX	881	2630	1630	1610	1280	2510	2440	3370	4540	1410	1190	1780
MIN	234	537	625	702	460	426	900	581	1200	333	258	336
CFSM	.44	1.44	.81	.83	.57	1.13	1.26	.67	1.69	.49	.39	.56
IN.	.50	1.60	.94	.96	.59	1.30	1.41	.77	1.89	.56	.45	.62

CAL YR 1988 TOTAL 296173 MEAN 809 MAX 3680 MIN 84 CFSM .66 IN 8.96
WTR YR 1989 TOTAL 383448 MEAN 1051 MAX 4540 MIN 234 CFSM .85 IN 11.60

04114000 GRAND RIVER AT PORTLAND, MI

LOCATION.--Lat 42°51'23", long 84°54'44", in NW1/4 sec.4, T.5 N., R.5 W., Ionia County, Hydrologic Unit 04050004, on left bank at downstream side of bridge on Kent Street, 1.0 mi south of Portland, 1.9 mi upstream from Looking Glass River, and at mile 115.

DRAINAGE AREA.--1,385 mi².

PERIOD OF RECORD.--August 1952 to March 1982, June 1988 to current year. Gage-height records collected in this vicinity 1907-28 (flood seasons only) are contained in reports of the National Weather Service.

GAGE.--Water-stage recorder. Datum of gage is 705.00 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to July 6, 1953, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Feb. 7-14. Records good. Slight diurnal fluctuation caused by powerplants upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--30 years (water years 1953-81, 1989), 921 ft³/s, 9.03 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 12,400 ft³/s, Apr. 21, 1975, gage height, 12.98 ft; minimum, 38 ft³/s, Oct. 10, 1963; minimum daily, 58 ft³/s, Oct. 9, 1963.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 7,580 ft³/s, June 1, gage height, 10.83 ft; minimum daily, 335 ft³/s, Aug. 27.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	574	802	1910	1420	1280	544	2380	1020	7030	1690	550	461
2	540	739	1840	1260	1360	539	2130	978	6100	1520	531	606
3	733	720	1650	1270	1380	534	2050	966	5590	1430	553	446
4	549	717	1590	1080	1240	574	2320	932	5300	1280	507	474
5	564	786	1510	970	994	714	2610	907	4660	1140	915	485
6	629	1390	1420	859	901	979	2730	872	4090	1040	1230	417
7	444	1680	1380	921	900	1090	2710	819	3530	920	917	589
8	467	1790	1330	2000	900	907	2520	799	3050	855	632	1010
9	432	1760	1270	2050	880	854	2400	740	2670	805	677	1910
10	582	3440	1220	1850	870	960	2200	726	2320	775	555	1890
11	387	3500	1100	1580	850	1060	2110	713	2050	706	543	1670
12	375	3310	898	1680	820	1100	1990	705	1890	628	525	1410
13	433	3250	807	1740	840	1140	1950	804	1830	607	524	1150
14	383	2980	917	1500	820	1150	1880	783	1680	596	559	999
15	417	2590	1080	1210	781	1660	1810	773	1690	515	543	890
16	406	2480	1040	1190	765	1890	1730	812	1640	483	502	813
17	406	2370	939	1200	730	1790	1620	764	1580	476	460	940
18	736	2410	861	1120	710	1790	1560	746	1460	453	447	828
19	694	2710	778	1090	706	2230	1550	736	1380	441	402	846
20	887	2910	797	1040	719	2550	1490	843	1610	485	420	785
21	946	3000	932	1060	740	2800	1430	837	1500	456	550	700
22	941	2720	949	896	705	2480	1410	866	1480	509	459	708
23	979	2570	878	968	647	2310	1340	800	1710	575	493	662
24	1010	2410	1010	864	624	2170	1250	754	1690	544	425	617
25	1170	2210	1070	909	633	2170	1250	864	1570	482	419	580
26	1200	2040	1120	908	561	2120	1190	1190	1500	436	374	596
27	1090	2080	1050	962	629	2030	1200	1180	1520	492	335	559
28	1110	2070	1410	956	630	2130	1140	1070	1870	517	348	546
29	1010	2080	1380	1010	---	2840	1120	931	1750	527	617	536
30	936	2050	1480	1020	---	2760	1080	1160	1860	540	627	462
31	884	---	1320	1190	---	2580	---	4200	---	529	497	---
TOTAL	21914	65624	36936	37773	23615	50445	54150	30290	77600	22452	17136	24585
MEAN	707	2187	1191	1218	843	1627	1805	977	2587	724	553	820
MAX	1200	3500	1910	2050	1380	2840	2730	4200	7030	1690	1230	1910
MIN	375	717	778	859	561	534	1080	705	1380	436	335	417
CFSM	.51	1.58	.86	.88	.61	1.18	1.30	.71	1.87	.52	.40	.59
IN.	.59	1.76	.99	1.01	.63	1.35	1.45	.81	2.08	.60	.46	.66

WTR YR 1989 TOTAL 462520 MEAN 1267 MAX 7030 MIN 335 CFSM .92 IN 12.42

04114500 LOOKING GLASS RIVER NEAR EAGLE, MI

LOCATION.--Lat 42°49'45", long 84°46'40", in sec.10, T.5 N., R.4 W., Clinton County, Hydrologic Unit 04050004, on right bank at upstream side of former bridge site on Hinman Road, 1.5 mi northeast of Eagle, and 10 mi upstream from mouth.

DRAINAGE AREA.--281 mi².

PERIOD OF RECORD.--August 1944 to current year.

REVISED RECORDS.--WSP 1387: 1946-47.

GAGE.--Water-stage recorder. Datum of gage is 747.09 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to June 2, 1962, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 13-20, Dec. 31 to Jan. 16, Jan. 22, 23, and Feb. 5 to Mar. 12. Records good except for estimated daily discharges, which are poor. Small intermittent diversion at times into Lake Geneva when discharge is above 50 ft³/s. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--45 years, 177 ft³/s, 8.55 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,860 ft³/s, Apr. 5, 1947, gage height, 7.70 ft, from graph based on gage readings, from rating curve extended above 1,900 ft³/s; maximum gage height, 9.9 ft, Mar. 7, 1956, from floodmark, backwater from ice; minimum discharge, 10 ft³/s, July 28, 1965, gage height, 1.01 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,410 ft³/s, May 31, gage height, 5.57 ft; minimum, 51 ft³/s, Aug. 3, 4, gage height, 1.56 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	89	132	273	160	199	78	402	155	1120	400	57	135
2	94	129	266	170	193	76	409	149	767	393	55	135
3	94	124	262	175	183	74	459	143	586	445	52	126
4	86	120	253	170	172	85	518	137	559	430	59	120
5	79	148	246	160	155	105	519	135	525	407	96	116
6	76	331	237	150	145	140	475	131	521	385	101	114
7	73	329	226	170	140	155	443	126	520	359	85	205
8	72	281	215	220	135	130	424	122	515	325	82	468
9	77	251	204	290	130	125	413	117	504	290	80	431
10	79	1070	196	220	125	130	401	110	483	257	81	418
11	77	667	186	200	125	135	384	105	443	218	77	404
12	73	486	153	200	120	140	371	103	405	188	69	430
13	68	463	125	195	120	146	354	113	379	161	66	478
14	66	429	135	195	120	164	330	115	338	138	60	526
15	64	411	140	190	115	275	316	114	306	120	64	563
16	66	434	140	185	115	226	296	114	287	105	73	586
17	84	435	140	182	115	219	281	112	251	91	68	602
18	123	412	135	174	110	230	266	109	224	80	65	586
19	128	399	120	172	110	242	252	109	230	75	63	542
20	105	405	125	168	105	278	237	113	284	75	69	494
21	102	423	127	155	100	267	233	110	266	74	72	450
22	111	388	127	150	100	257	224	106	256	77	148	407
23	119	362	148	145	95	279	213	104	318	76	194	362
24	165	343	153	142	92	312	201	100	345	71	142	327
25	186	327	148	140	90	319	196	121	333	66	119	295
26	169	317	152	148	87	307	192	127	344	63	117	264
27	151	334	148	149	84	307	183	122	442	61	116	236
28	142	322	195	148	82	375	176	129	481	59	114	212
29	137	298	202	158	---	504	170	141	447	55	118	189
30	135	283	185	179	---	442	164	219	416	57	122	168
31	133	---	180	184	---	411	---	959	---	59	113	---
TOTAL	3223	10853	5542	5444	3462	6933	9502	4670	12894	5660	2797	10389
MEAN	104	362	179	176	124	224	317	151	430	183	90.2	346
MAX	186	1070	273	290	199	504	519	959	1120	445	194	602
MIN	64	120	120	140	82	74	164	100	224	55	52	114
CFSM	.37	1.29	.64	.63	.44	.80	1.13	.54	1.53	.65	.32	1.23
IN.	.43	1.44	.73	.72	.46	.92	1.26	.62	1.71	.75	.37	1.38

CAL YR 1988 TOTAL 66098 MEAN 181 MAX 1140 MIN 24 CFSM .64 IN 8.75
WTR YR 1989 TOTAL 81369 MEAN 223 MAX 1120 MIN 52 CFSM .79 IN 10.77

04115000 MAPLE RIVER AT MAPLE RAPIDS, MI

LOCATION.--Lat 43°06'35", long 84°41'35", in sec.5, T.8 N., R.3 W., Clinton County, Hydrologic Unit 04050005, on right bank at downstream side of bridge on Maple Road in Maple Rapids, 50 ft upstream from Pine Creek, and 0.8 mi upstream from Hayworth Creek. Records include flow of Pine Creek.

DRAINAGE AREA.--434 mi^2.

PERIOD OF RECORD.--August 1944 to current year.

REVISED RECORDS.--WSP 1707: 1956.

GAGE.--Water-stage recorder. Datum of gage is 642.58 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Oct. 4, 1968, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Jan. 4, 12-14, Feb. 3-9, 16-18, 21-24, Feb. 27 to Mar. 2, and Mar. 17-19, 21, 22. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--45 years, 268 ft^3/s, 8.39 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 8,770 ft^3/s, Sept. 12, 1986, gage height, 12.33 ft, from floodmark, caused by dam failure on Rainbow Lake (Pine Creek); minimum, 4.4 ft^3/s, Aug. 13, 1965, gage height, 1.62 ft.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood in March 1904 reached a stage of 13.8 ft, from information by local resident.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,840 ft^3/s, June 25, gage height, 8.71 ft; minimum, 35 ft^3/s, Aug. 3, gage height, 2.01 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	84	165	456	187	286	74	1190	208	866	851	45	67
2	93	152	420	174	289	69	1050	196	1160	728	42	72
3	102	137	397	158	265	69	940	185	1280	625	39	74
4	99	124	374	140	240	71	897	171	1280	542	47	68
5	94	127	351	126	220	76	911	161	1210	470	77	60
6	86	281	330	122	200	90	897	155	1090	402	84	60
7	77	433	312	123	185	102	848	142	959	351	79	156
8	67	527	289	419	165	99	783	137	844	299	72	236
9	61	572	266	520	150	92	729	139	744	253	63	331
10	57	762	245	557	137	110	676	135	656	214	56	426
11	55	1130	225	572	124	215	626	128	578	179	51	515
12	50	1350	203	550	117	330	579	122	514	137	49	564
13	46	1410	183	520	113	336	545	130	460	106	47	578
14	42	1350	172	470	108	337	521	133	411	87	45	558
15	40	1210	164	414	108	516	567	132	379	76	48	512
16	40	1070	153	373	105	673	583	126	358	67	51	459
17	45	998	134	336	100	725	570	118	342	59	51	409
18	114	922	124	307	95	690	540	105	324	55	49	368
19	177	836	118	287	89	625	500	99	324	52	45	333
20	191	764	122	270	88	562	460	104	421	52	45	299
21	190	731	138	241	85	505	429	104	492	54	49	264
22	189	703	134	214	83	455	399	100	538	54	59	235
23	188	666	148	192	80	416	372	93	637	57	95	206
24	205	621	169	180	79	428	343	83	1450	56	103	182
25	224	575	169	169	77	591	318	99	1830	51	91	154
26	232	537	153	168	79	815	296	140	1820	47	76	128
27	230	508	162	179	77	959	272	153	1660	47	64	109
28	217	505	212	181	75	1070	255	149	1420	51	57	96
29	208	499	222	186	---	1350	239	132	1180	49	53	88
30	194	479	221	222	---	1450	221	224	994	48	61	80
31	177	---	202	259	---	1350	---	535	---	47	68	---
TOTAL	3874	20144	6968	8816	3819	15250	17556	4638	26221	6166	1861	7687
MEAN	125	671	225	284	136	492	585	150	874	199	60.0	256
MAX	232	1410	456	572	289	1450	1190	535	1830	851	103	578
MIN	40	124	118	122	75	69	221	83	324	47	39	60
CFSM	.29	1.55	.52	.65	.31	1.13	1.35	.35	2.01	.46	.14	.59
IN.	.33	1.73	.60	.76	.33	1.31	1.50	.40	2.25	.53	.16	.66

CAL YR 1988 TOTAL 84849.2 MEAN 232 MAX 1680 MIN 8.7 CFSM .54 IN 7.27
WTR YR 1989 TOTAL 123000.0 MEAN 337 MAX 1830 MIN 39 CFSM .78 IN 10.54

04115265 FISH CREEK NEAR CRYSTAL, MI

LOCATION.--Lat 43°14'59", long 84°58'52", in NW1/4 NE1/4 sec.23, T.10 N., R.6 W., Montcalm County, Hydrologic Unit 04050005, on left bank 10 ft downstream from bridge on Sidney Road, 3.5 mi southwest of Crystal.

DRAINAGE AREA.--50.5 mi².

PERIOD OF RECORD.--October 1987 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 795 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: July 31 and Sept. 20. Records good. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 204 ft³/s, Mar. 15, 1989, gage height, 5.42 ft; minimum, 7.0 ft³/s, July 10, 14, 1988, gage height, 2.27 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 204 ft³/s, Mar. 15, gage height, 5.42 ft; minimum, 11 ft³/s, Aug. 3, 4; minimum gage height, 2.30 ft, Aug. 4.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	24	25	35	26	42	22	47	31	137	21	12	26
2	61	24	32	26	33	22	44	29	80	19	12	24
3	45	23	31	25	31	21	46	28	53	19	11	19
4	35	23	29	25	28	23	58	26	63	18	47	18
5	29	36	29	26	26	23	60	25	43	18	52	17
6	26	86	29	25	26	22	46	24	36	17	30	22
7	23	71	29	26	26	22	41	24	31	16	24	52
8	23	53	27	39	25	24	38	24	29	15	22	35
9	23	43	26	33	26	22	39	24	28	18	21	30
10	23	97	25	30	26	22	37	23	27	16	20	26
11	23	100	23	27	26	28	35	23	25	14	19	22
12	22	55	22	28	25	60	37	23	25	15	18	21
13	21	60	23	28	25	46	37	27	28	14	18	20
14	21	48	24	26	25	62	39	25	32	15	21	22
15	20	40	25	26	25	182	46	25	29	15	27	21
16	22	47	22	26	25	176	38	24	34	15	21	20
17	31	47	22	26	23	85	36	21	32	14	18	21
18	40	38	22	26	23	54	33	21	29	13	17	19
19	34	41	22	28	24	44	32	24	46	14	16	18
20	30	42	28	29	24	40	30	28	51	16	20	17
21	28	37	32	26	24	36	32	25	34	18	20	17
22	32	34	29	25	24	34	32	29	32	18	28	17
23	30	31	45	25	23	35	35	25	38	16	31	16
24	44	30	40	27	23	47	31	20	30	15	24	17
25	38	30	34	27	23	108	29	32	27	14	21	17
26	32	31	29	35	23	110	29	29	25	14	19	17
27	28	53	32	32	23	82	28	24	25	17	18	16
28	27	45	39	30	22	90	28	22	25	18	18	17
29	25	40	33	32	---	115	32	22	23	16	25	16
30	24	37	30	44	---	70	29	96	22	15	21	16
31	23	---	28	40	---	55	---	152	---	14	18	---
TOTAL	907	1367	896	894	719	1782	1124	975	1139	497	689	636
MEAN	29.3	45.6	28.9	28.8	25.7	57.5	37.5	31.5	38.0	16.0	22.2	21.2
MAX	61	100	45	44	42	182	60	152	137	21	52	52
MIN	20	23	22	25	22	21	28	20	22	13	11	16
CFSM	.58	.90	.57	.57	.51	1.14	.74	.62	.75	.32	.44	.42
IN.	.67	1.01	.66	.66	.53	1.31	.83	.72	.84	.37	.51	.47

CAL YR 1988 TOTAL 10750.2 MEAN 29.4 MAX 140 MIN 8.1 CFSM .58 IN 7.92
WTR YR 1989 TOTAL 11625.0 MEAN 31.8 MAX 182 MIN 11 CFSM .63 IN 8.56

04116000 GRAND RIVER AT IONIA, MI

LOCATION.--Lat 42°58'20", long 85°04'13", in NW1/4 sec.30, T.7 N., R.6 W., Ionia County, Hydrologic Unit 04050006, on left bank 15 ft downstream from bridge on State Highway 66 in Ionia, 2.7 mi downstream from Prairie Creek, and at mile 87.

DRAINAGE AREA.--2,840 mi^2, approximately.

PERIOD OF RECORD.--March to June 1931, July and September 1931 (fragmentary), July 1951 to current year. Gage-height records collected in this vicinity 1907-28 (flood seasons only) are contained in reports of the National Weather Service.

GAGE.--Water-stage recorder. Datum of gage is 615.38 ft above National Geodetic Vertical Datum of 1929. Mar. 19 to Sept. 24, 1931, nonrecording gage at site 1.5 mi upstream at different datum.

REMARKS.--Estimated daily discharges: Dec. 17-20, Jan. 6-18, and Feb. 8 to Mar. 4. Records good except for estimated daily discharges, which are fair. Diurnal fluctuation below about 5,000 ft^3/s caused by powerplants upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--38 years (water years 1952-89), 1,964 ft^3/s, 9.39 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 21,500 ft^3/s, Apr. 1, 1960, gage height, 23.43 ft; minimum, 40 ft^3/s, May 13, 1968, gage height, 5.61 ft; minimum daily, 109 ft^3/s, July 16, 1977.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 11,000 ft^3/s, June 2, gage height, 19.54 ft; minimum, 542 ft^3/s, Oct. 15, gage height, 7.63 ft; minimum daily, 677 ft^3/s, Oct. 15.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1290	1620	3560	1970	2350	920	5820	1890	8310	3880	839	1000
2	1220	1640	3310	2310	2400	910	5260	1810	10700	3510	834	1110
3	1260	1450	3190	2190	2240	900	4790	1760	10700	3160	823	945
4	1350	1480	2950	1930	2270	1000	4910	1760	9870	2970	916	877
5	1160	1500	2860	1810	1990	1250	5210	1610	9040	2720	1410	855
6	1090	2690	2690	1700	1760	1770	5290	1490	8040	2310	1610	851
7	1080	4140	2630	2000	1500	2070	5140	1470	7060	2150	1680	1300
8	975	3990	2470	3400	1500	2320	4870	1420	6170	1890	1160	2490
9	953	3890	2340	3900	1500	1510	4590	1410	5380	2080	1040	3510
10	886	5170	2240	3500	1500	1510	4230	1330	4650	1660	1050	3860
11	1080	7720	1920	3000	1450	2140	3980	1180	4070	1420	1030	3210
12	941	8130	1880	3200	1400	2530	3920	1190	3550	1400	933	2860
13	708	7870	1600	3300	1400	2320	3700	1280	3450	1230	843	2490
14	886	7290	1830	2800	1350	2470	3620	1380	3300	1110	894	2230
15	677	6580	1880	2300	1350	4430	3630	1290	2970	997	984	2220
16	914	5930	1930	2250	1300	4790	3380	1410	2900	874	1010	2180
17	738	5650	1800	2250	1250	4440	3440	1300	2880	847	916	2210
18	1330	5180	1650	2200	1200	3930	3310	1160	2490	895	841	2320
19	1800	4950	1500	2120	1200	3920	3090	1370	2570	811	814	2120
20	1820	5100	1600	2230	1200	4230	2990	1380	2790	800	764	1950
21	1880	5250	1740	1960	1250	4330	2740	1310	2830	816	831	1760
22	1880	5110	1750	1900	1200	4280	2730	1470	3110	796	1030	1850
23	1900	4730	1780	1750	1100	3870	2550	1060	3170	1050	1340	1510
24	2080	4420	1880	1640	1050	4130	2410	1240	3730	969	1140	1430
25	2300	4140	1920	1630	1050	4580	2350	1420	3950	830	995	1330
26	2490	3850	1830	1690	1000	4660	2250	1730	4200	846	938	1240
27	2160	3800	1960	1830	1000	4730	2150	1770	4290	766	892	1150
28	2220	3830	2210	1760	980	4800	2080	1720	4250	711	829	1340
29	2020	3660	2490	1810	---	5840	2030	1520	4380	815	734	1320
30	1950	3600	2420	1960	---	6500	1900	2040	4090	844	1210	772
31	1890	---	2050	2140	---	6310	---	4630	---	817	1030	---
TOTAL	44928	134360	67860	70430	40740	103390	108360	48800	148890	45974	31360	54290
MEAN	1449	4479	2189	2272	1455	3335	3612	1574	4963	1483	1012	1810
MAX	2490	8130	3560	3900	2400	6500	5820	4630	10700	3880	1680	3860
MIN	677	1450	1500	1630	980	900	1900	1060	2490	711	734	772
CFSM	.51	1.58	.77	.80	.51	1.17	1.27	.55	1.75	.52	.36	.64
IN.	.59	1.76	.89	.92	.53	1.35	1.42	.64	1.95	.60	.41	.71

CAL YR 1988 TOTAL 742480 MEAN 2029 MAX 9160 MIN 269 CFSM .71 IN 9.73
WTR YR 1989 TOTAL 899382 MEAN 2464 MAX 10700 MIN 677 CFSM .87 IN 11.78

STREAMS TRIBUTARY TO LAKE MICHIGAN

04117500 THORNAPPLE RIVER NEAR HASTINGS, MI

LOCATION.--Lat 42°36'57", long 85°14'11", in SE1/4 sec.27, T.3 N., R.8 W., Barry County, Hydrologic Unit 04050007, on right bank at downstream side of bridge on McKeown Road, 0.6 mi downstream from Cedar Creek, 2.0 mi downstream from Thornapple Lake, and 3.2 mi southeast of Hastings.

DRAINAGE AREA.--385 mi².

PERIOD OF RECORD.--October 1944 to current year.

GAGE.--Water-stage recorder. Datum of gage is 786.71 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Oct. 1, 1965, nonrecording gage at same site and datum.

REMARKS.--No estimated daily discharges. Records good. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--45 years, 322 ft³/s, 11.36 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,810 ft³/s, Apr. 7, 1947, gage height, 10.20 ft, from graph based on gage readings; minimum, 33 ft³/s, Aug. 10, 1964; minimum gage height, 2.71 ft, Aug. 10, 1964, July 14, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,560 ft³/s, June 3, gage height, 8.26 ft; minimum, 122 ft³/s, Aug. 4, gage height, 3.07 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	342	341	503	360	467	185	1050	244	1820	253	143	382
2	314	315	463	349	479	171	969	234	3130	227	134	392
3	303	293	433	313	441	177	857	231	3540	212	128	353
4	298	280	405	261	368	191	782	228	3310	204	138	300
5	288	284	381	242	293	218	792	221	2860	195	223	254
6	267	347	363	257	280	249	820	218	2340	183	313	226
7	244	489	350	263	263	250	812	209	1870	172	354	251
8	226	673	335	400	254	243	754	203	1470	163	342	291
9	214	800	319	527	239	248	653	199	1130	159	290	339
10	205	1240	304	642	229	253	575	194	835	157	236	398
11	198	1880	269	758	232	337	519	187	630	153	206	455
12	189	2150	231	761	231	511	481	181	507	146	188	480
13	179	2120	235	664	229	603	459	194	452	143	178	474
14	172	1940	258	524	227	605	437	206	426	146	166	430
15	167	1690	266	431	230	721	421	209	426	148	165	368
16	167	1490	235	383	229	881	403	210	398	141	173	323
17	181	1360	216	339	213	923	390	203	376	134	167	296
18	221	1210	215	312	196	853	380	193	352	128	156	271
19	275	1050	219	303	206	750	363	192	328	126	146	249
20	317	913	239	313	210	706	346	210	339	138	150	229
21	329	839	271	305	211	686	335	221	342	150	166	213
22	329	809	279	285	206	651	323	212	327	152	168	200
23	330	782	296	273	182	603	308	195	319	150	172	185
24	354	731	344	270	171	581	293	179	426	152	168	175
25	419	664	365	275	189	613	286	201	486	154	157	167
26	492	601	354	297	196	661	287	249	470	149	145	163
27	534	569	342	338	194	674	280	254	412	145	137	157
28	521	567	376	351	185	687	270	226	381	147	145	152
29	484	562	428	350	---	847	259	199	341	141	233	150
30	432	534	383	380	---	1010	250	237	291	147	303	147
31	380	---	367	427	---	1070	---	622	---	151	339	---
TOTAL	9371	27523	10044	11953	7050	17158	15154	6961	30334	4966	6129	8470
MEAN	302	917	324	386	252	553	505	225	1011	160	198	282
MAX	534	2150	503	761	479	1070	1050	622	3540	253	354	480
MIN	167	280	215	242	171	171	250	179	291	126	128	147
CFSM	.78	2.38	.84	1.00	.66	1.44	1.31	.58	2.63	.42	.51	.73
IN.	.91	2.66	.97	1.15	.68	1.66	1.46	.67	2.93	.48	.59	.82

CAL YR 1988 TOTAL 132373 MEAN 362 MAX 2150 MIN 50 CFSM .94 IN 12.79
WTR YR 1989 TOTAL 155113 MEAN 425 MAX 3540 MIN 126 CFSM 1.10 IN 14.99

04118000 THORNAPPLE RIVER NEAR CALEDONIA, MI

LOCATION.--Lat 42°48'40", long 85°29'00", in NW1/4 sec.22, T.5 N., R.10 W., Kent County, Hydrologic Unit 04050007, on right bank 200 ft downstream from LaBarge powerplant, 2.3 mi northeast of Caledonia, and 3.3 mi downstream from Coldwater River.

DRAINAGE AREA.--773 mi².

PERIOD OF RECORD.--October 1930 to September 1938, October 1951 to March 1982, October 1983 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 824: 1931-36. WSP 1307: 1931-37.

GAGE.--Water-stage recorder. Datum of gage is 676.31 ft, Consumers Power Co. datum. Oct. 1, 1930, to Sept. 30, 1938, nonrecording gage at same site and at National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Aug. 4-8. Records good. Prior to Dec. 1, 1958, and since Oct. 1, 1983, large diurnal fluctuation at low and medium flow, and occasional regulation during high flow, caused by powerplant upstream from station; occasional fluctuation during the interim period. Several measurements of water temperature were made during the year. Gage-height telemeter at station.

AVERAGE DISCHARGE.--44 years (water years 1931-39, 1952-81, 1984-89), 599 ft³/s, 10.52 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,700 ft³/s, Feb. 27, 1985, gage height, 11.43 ft; minimum, 1.0 ft³/s, May 28, 1968, gage height, 1.40 ft, result of regulation during bridge construction.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Apr. 7, 1947, reached a stage of 14.4 ft, from information by powerplant operator.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 5,040 ft³/s, June 4, gage height, 9.82 ft; minimum daily, 266 ft³/s, July 14.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	677	671	937	676	758	401	1690	481	3190	529	357	487
2	599	626	876	656	795	381	1640	504	3880	518	360	628
3	620	564	749	645	762	351	1540	439	4370	453	317	553
4	538	555	764	527	694	423	1430	479	4730	459	330	531
5	542	564	728	526	621	462	1420	497	4480	399	380	449
6	509	706	701	547	568	438	1360	399	3910	419	500	421
7	478	984	673	529	515	394	1320	399	3250	327	570	520
8	465	1150	651	765	513	504	1230	444	2750	412	500	560
9	408	1340	608	899	415	505	1170	378	2080	363	437	667
10	473	1880	601	1050	458	463	1010	417	1650	328	522	670
11	381	2330	546	1210	506	551	921	398	1370	386	419	637
12	385	2590	482	1240	520	901	893	365	1000	283	423	653
13	399	2740	539	1170	508	1030	908	386	1010	390	326	659
14	377	2650	473	926	481	1180	820	418	821	266	412	655
15	349	2440	536	813	400	2000	872	421	849	389	439	639
16	359	2320	487	737	507	1920	829	413	826	304	383	553
17	451	2100	486	669	447	1900	738	416	733	323	385	466
18	435	1930	469	641	348	1770	755	412	699	309	368	509
19	539	1820	443	571	488	1530	698	404	684	296	353	485
20	507	1730	500	612	398	1440	671	404	683	395	320	421
21	569	1550	555	563	484	1360	649	439	671	313	380	415
22	557	1440	564	554	404	1250	643	428	674	391	393	403
23	548	1430	622	546	400	1180	569	404	632	325	429	382
24	633	1190	636	520	336	1270	606	405	639	366	421	330
25	713	1180	673	558	439	1240	529	460	739	351	355	368
26	795	1070	668	550	405	1310	561	503	754	333	394	342
27	932	1080	665	534	447	1260	557	510	714	386	312	345
28	887	1050	733	638	379	1370	538	500	692	362	349	326
29	803	982	777	631	---	1740	501	444	651	351	289	332
30	788	963	761	666	---	1800	494	614	571	397	472	331
31	763	---	733	700	---	1810	---	2160	---	316	491	---
TOTAL	17479	43625	19636	21869	13996	34134	27562	15341	49702	11439	12386	14737
MEAN	564	1454	633	705	500	1101	919	495	1657	369	400	491
MAX	932	2740	937	1240	795	2000	1690	2160	4730	529	570	670
MIN	349	555	443	520	336	351	494	365	571	266	289	326
CFSM	.73	1.88	.82	.91	.65	1.42	1.19	.64	2.14	.48	.52	.64
IN.	.84	2.10	.94	1.05	.67	1.64	1.33	.74	2.39	.55	.60	.71

CAL YR 1988 TOTAL 254292 MEAN 695 MAX 2740 MIN 172 CFSM .90 IN 12.24
WTR YR 1989 TOTAL 281906 MEAN 772 MAX 4730 MIN 266 CFSM 1.00 IN 13.57

04118500 ROGUE RIVER NEAR ROCKFORD, MI

LOCATION.--Lat 43°04'56", long 85°35'27", in NE1/4 sec. 15, T.8 N., R.11 W., Kent County, Hydrologic Unit 04050006, on left bank at downstream side of bridge on Packer Drive, 2.2 mi upstream from mouth, and 3.0 mi southwest of Rockford.

DRAINAGE AREA.--234 mi^2.

PERIOD OF RECORD.--February 1952 to September 1982, October 1987 to current year.

GAGE.--Water-stage recorder. Datum of gage is 624.80 ft above National Geodetic Vertical Datum of 1929 (levels by Johnson and Anderson, Inc.). Prior to Aug. 30, 1952, nonrecording gage at same site and datum.

REMARKS.--No estimated daily discharges. Records good. Some diurnal fluctuation caused by mills upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--32 years, 233 ft^3/s, 13.52 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,540 ft^3/s, Mar. 6, 1976, gage height, 9.29 ft; minimum, 28 ft^3/s, Jan. 22, 1967, gage height, 3.41 ft; minimum daily, 49 ft^3/s, Aug. 27, 1955.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Sept. 12, 1986, reached a stage of 11.35 ft, from floodmark, and discharge of about 6,000 ft^3/s.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,940 ft^3/s, June 1, gage height, 8.61 ft; minimum daily, 110 ft^3/s, Aug. 2.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	183	232	428	324	449	194	565	224	1800	244	114	184
2	201	221	393	299	384	193	471	222	1600	208	110	183
3	197	212	367	280	331	173	424	220	1110	193	116	179
4	220	228	342	242	303	198	414	212	830	188	521	166
5	213	355	324	249	272	191	402	209	615	186	776	156
6	203	477	308	223	253	196	393	205	501	177	1120	165
7	193	579	296	236	253	208	383	201	421	167	1000	177
8	182	657	[illegible]	337	251	200	365	189	352	157	668	174
9	174	640	272	313	245	189	339	185	321	149	468	197
10	168	835	257	356	254	200	312	184	285	147	358	225
11	164	844	221	325	248	237	294	183	258	145	297	233
12	160	787	195	318	245	316	286	174	242	142	251	222
13	157	763	213	334	238	357	274	181	241	144	219	192
14	157	694	239	345	227	543	290	181	236	144	207	182
15	156	597	256	297	225	1300	303	176	246	140	198	176
16	174	578	255	273	226	1330	295	179	262	137	191	170
17	195	548	240	267	220	1130	293	181	249	134	179	166
18	239	509	230	261	202	713	280	173	245	129	163	160
19	238	481	226	268	199	572	266	190	350	131	167	155
20	238	452	286	277	205	487	254	204	393	143	187	151
21	238	417	343	275	214	407	254	204	379	153	191	148
22	236	383	341	257	211	365	245	194	369	150	241	147
23	249	357	444	249	203	344	239	181	385	144	233	138
24	278	339	417	265	188	416	233	170	334	135	226	138
25	275	322	396	277	193	538	235	209	286	130	225	138
26	278	319	317	341	200	611	229	210	251	124	207	139
27	273	419	324	341	205	680	225	210	245	130	186	139
28	270	413	386	339	201	720	224	192	284	144	176	139
29	255	432	390	337	---	829	225	172	327	132	173	138
30	243	449	365	392	---	880	224	416	302	127	168	137
31	233	---	333	431	---	718	---	1110	---	123	163	---
TOTAL	6640	14539	9688	9328	6845	15435	9236	7141	13719	4697	9499	5014
MEAN	214	485	313	301	244	498	308	230	457	152	306	167
MAX	278	844	444	431	449	1330	565	1110	1800	244	1120	233
MIN	156	212	195	223	188	173	224	170	236	123	110	137
CFSM	.92	2.07	1.34	1.29	1.04	2.13	1.32	.98	1.95	.65	1.31	.71
IN.	1.06	2.31	1.54	1.40	1.09	2.45	1.47	1.14	2.18	.75	1.51	.80

CAL YR 1988	TOTAL 102402	MEAN 280	MAX 1580	MIN 82	CFSM 1.20	IN 16.28
WTR YR 1989	TOTAL 111781	MEAN 306	MAX 1800	MIN 110	CFSM 1.31	IN 17.77

04119000 GRAND RIVER AT GRAND RAPIDS, MI

LOCATION.--Lat 42°57'52", long 85°40'35", in NE1/4 sec.25, T.7 N., R.12 W., Kent County, Hydrologic Unit 04050006, on right bank 500 ft upstream from bridge on Fulton Street, 1.7 mi upstream from Plaster Creek, and at mile 41.

DRAINAGE AREA.--4,900 mi^2, approximately.

PERIOD OF RECORD.--March 1901 to December 1905, January 1906 to August 1918 (gage heights only), October 1930 to current year. Monthly discharge only for some periods, published in WSP 1307. Gage-height records collected in this vicinity since 1907 are contained in reports of the National Weather Service.

REVISED RECORDS.--WSP 924: 1938(M). WSP 1387: 1901-5, 1940.

GAGE.--Water-stage recorder. Datum of gage is 585.70 ft above National Geodetic Vertical Datum of 1929 (levels by City of Grand Rapids). March 1901 to August 1918, nonrecording gage at Fulton Street Bridge 500 ft downstream and Oct. 1, 1930, to Oct. 26, 1953, water-stage recorder at sewage pumping station 1 mi downstream at datum 2.99 ft higher.

REMARKS.--Estimated daily discharges: Feb 9 to Mar. 4. Records good except for estimated daily discharges, which are fair. Moderate diurnal fluctuation at low and medium flow caused by powerplants upstream from station. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--63 years, 3,645 ft^3/s, 10.10 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 54,000 ft^3/s, Mar. 28, 1904, gage height, 19.5 ft, from graph based on gage readings, site then in use; maximum gage height, 19.64 ft, Mar. 1, 1985; minimum daily discharge, 381 ft^3/s, Aug. 9, 17, 1936.

EXTREMES OUTSIDE PERIOD OF RECORD.--Maximum discharge since at least 1901, that of Mar. 28, 1904.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 17,100 ft^3/s, June 5, gage height, 15.20 ft, minimum, 1,740 ft^3/s, Oct. 16; minimum gage height, 3.21 ft, Aug. 4.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2880	3820	6410	4350	4850	2200	10300	3600	10400	5860	2180	2420
2	3040	3510	6170	4310	4990	2200	9960	3290	12500	5530	2180	2620
3	2830	3300	5920	4470	4890	2200	9370	3540	14500	5200	2130	2560
4	2970	3230	5670	3780	4640	2500	8700	3480	16500	4820	3220	2340
5	2860	3920	5350	3440	4290	2960	8490	3440	17000	4640	4070	2160
6	2630	4770	5230	3270	3970	3270	8430	3360	16400	4170	4650	2330
7	2430	6120	5070	3850	3730	3350	8360	3060	15100	3830	4720	2540
8	2360	7130	5000	4940	2850	3290	8150	3090	13400	3470	4250	3890
9	2280	7190	4620	4520	2800	3270	7730	3060	11800	3350	3560	5110
10	2130	8510	4510	5000	2800	3320	7270	3000	10100	3380	3040	5560
11	2150	9730	4330	5730	2750	3770	6760	2950	8350	3050	2860	5460
12	2150	10800	3390	6370	2750	4950	6470	2860	6990	2830	2620	4900
13	2070	12000	3110	6580	2700	5200	6320	2910	6090	2760	2490	4580
14	1930	12500	3660	6440	2700	5460	6170	2980	5770	2730	2290	4210
15	1960	12300	4020	5810	2700	8200	6350	3060	5460	2550	2500	3950
16	1920	11900	3380	5810	2650	9700	6200	3060	5220	2460	2700	3810
17	2400	11100	2950	5400	2650	9660	5940	3140	5130	2290	2570	3610
18	2530	10200	3080	5170	2650	9270	5740	2970	4890	2190	2340	3540
19	3030	9340	3400	5110	2700	8510	5570	3020	4720	2300	2190	3580
20	3530	8770	4230	4690	2800	8050	5290	3240	5020	2270	2220	3340
21	4010	8460	4560	4480	2750	7930	5520	3130	5110	2370	2140	3090
22	3980	8260	4220	4230	2700	7630	4990	3080	5220	2270	2490	2770
23	3680	8030	4530	3980	2600	7390	4850	3120	5580	2390	2840	2730
24	4070	7660	4520	3910	2550	7120	4460	2840	5990	2440	2920	2460
25	4190	7130	4510	3690	2500	7510	4230	3170	6010	2430	2720	2300
26	4570	6780	4440	3920	2400	7850	4170	3440	6090	2240	2440	2240
27	4720	6950	4500	4030	2350	8110	4310	3510	6390	2310	2260	2110
28	4550	6770	4840	4100	2300	8470	4270	3510	6280	2360	2250	2130
29	4400	6620	4980	4150	---	9270	3930	3320	6210	2200	2090	2380
30	4130	6510	4670	4350	---	9890	3920	4120	6200	2220	2030	2280
31	3990	---	4780	4570	---	10300	---	7230	---	2320	2490	---
TOTAL	96370	233310	140050	144450	87010	192800	192220	103580	254420	95230	85450	97000
MEAN	3109	7777	4518	4660	3108	6219	6407	3341	8481	3072	2756	3233
MAX	4720	12500	6410	6580	4990	10300	10300	7230	17000	5860	4720	5560
MIN	1920	3230	2950	3270	2300	2200	3920	2840	4720	2190	2030	2110
CFSM	.63	1.59	.92	.95	.63	1.27	1.31	.68	1.73	.63	.56	.66
IN.	.73	1.77	1.06	1.10	.66	1.46	1.46	.79	1.93	.72	.65	.74

CAL YR 1988 TOTAL 1463581 MEAN 3999 MAX 12500 MIN 800 CFSM .82 IN 11.11
WTR YR 1989 TOTAL 1721890 MEAN 4718 MAX 17000 MIN 1920 CFSM .96 IN 13.07

04119300 GRAND RIVER AT EASTMANVILLE, MI
(National stream quality accounting network station)

LOCATION.--Lat 43°00'53", long 85°57'21", in NE1/4 NW1/4 sec.10, T.7 N., R.14 W., Ottawa County, Hydrologic Unit 04050006, at bridge on 68th Avenue in Eastmanville, 1.1 mi downstream from Deer Creek, and at mile 19.3.

DRAINAGE AREA.--5,230 mi^2, approximately.

PERIOD OF RECORD.--Water years 1979 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: February 1979 to September 1983.
WATER TEMPERATURE: February 1979 to September 1983.

INSTRUMENTATION.--Water-quality monitor from Oct. 7, 1980 to Sept. 30, 1983.

REMARKS.--Bimonthly cross-sectional samples were collected at bridge. A water-discharge measurement was made at time of sampling.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1979-82): Maximum daily recorded (more than 20 percent missing record), 1,100 microsiemens, Mar. 2, 1979; minimum measured, 324 microsiemens, Mar. 24, 1982.
WATER TEMPERATURE (water years 1980-81, 1983): Maximum, 28.5°C, July 21, 1983; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
NOV 14...	1430	13800	526	8.1	6.0	32	11.0	90	E830	>1000
JAN 20...	1300	5100	642	8.2	0.0	18	13.9	96	K1800	750
MAR 17...	1500	11200	423	8.0	2.0	210	13.0	96	K330	>2000
MAY 11...	1430	2940	671	8.8	15.0	7.8	14.7	149	K30	K5
JUL 19...	1400	2110	651	8.5	23.0	16	11.0	132	K160	K40
SEP 14...	1200	4760	559	8.3	18.0	20	8.0	86	K230	K370

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
NOV 14...	250	90	67	19	12	9	0.3	3.9	190	0
JAN 20...	290	--	79	23	23	14	0.6	3.3	--	--
MAR 17...	190	--	52	15	13	13	0.4	3.8	--	--
MAY 11...	320	100	85	26	29	16	0.7	2.7	232	--
JUL 19...	290	78	78	24	31	18	0.8	2.9	244	10
SEP 14...	250	60	68	20	20	14	0.5	3.9	234	0

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)
NOV 14...	156	58	24	0.2	8.4	301	0.41	11200	0.03
JAN 20...	--	68	39	0.1	8.1	385	0.52	5300	0.03
MAR 17...	--	39	22	0.2	4.6	254	0.35	7680	0.03
MAY 11...	218	65	48	0.2	0.06	413	0.56	3280	0.04
JUL 19...	216	57	50	0.3	4.9	383	0.52	2180	0.06
SEP 14...	192	47	33	0.2	8.3	336	0.46	4320	0.05

04119300 GRAND RIVER AT EASTMANVILLE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N)	NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHOROUS TOTAL (MG/L AS P)	PHOS-PHOROUS DIS-SOLVED (MG/L AS P)	PHOS-PHOROUS ORTHO, DIS-SOLVED (MG/L AS P)	ALUM-INUM, DIS-SOLVED (UG/L AS AL)	ARSENIC DIS-SOLVED (UG/L AS AS)	BARIUM, DIS-SOLVED (UG/L AS BA)
NOV 14...	3.7	0.12	0.11	1.6	0.10	0.05	0.04	10	1	41
JAN 20...	2.2	0.48	0.43	1.3	0.07	0.05	0.03	--	--	--
MAR 17...	2.1	0.51	0.47	1.4	0.19	0.07	0.06	30	1	29
MAY 11...	0.72	0.22	0.27	1.8	0.03	0.01	<0.01	10	<1	51
JUL 19...	0.65	0.09	0.09	1.3	0.11	0.02	<0.01	--	--	--
SEP 14...	1.4	0.08	0.08	1.0	0.14	0.05	0.03	<10	<1	66

DATE	BERYL-LIUM, DIS-SOLVED (UG/L AS BE)	CADMIUM DIS-SOLVED (UG/L AS CD)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COBALT, DIS-SOLVED (UG/L AS CO)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, DIS-SOLVED (UG/L AS FE)	LEAD, DIS-SOLVED (UG/L AS PB)	LITHIUM DIS-SOLVED (UG/L AS LI)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY DIS-SOLVED (UG/L AS HG)
NOV 14...	<0.5	<1	<1	<3	2	50	<5	9	11	<0.1
JAN 20...	--	--	--	--	--	--	--	--	--	--
MAR 17...	<0.5	<1	<1	<3	3	40	<5	<4	13	<0.1
MAY 11...	<0.5	<1	1	<3	2	9	<1	10	3	<0.1
JUL 19...	--	--	--	--	--	--	--	--	--	--
SEP 14...	<0.5	<1	2	<3	2	10	<1	7	<1	<0.1

DATE	MOLYB-DENUM, DIS-SOLVED (UG/L AS MO)	NICKEL, DIS-SOLVED (UG/L AS NI)	SELE-NIUM, DIS-SOLVED (UG/L AS SE)	SILVER, DIS-SOLVED (UG/L AS AG)	STRON-TIUM, DIS-SOLVED (UG/L AS SR)	VANA-DIUM, DIS-SOLVED (UG/L AS V)	ZINC, DIS-SOLVED (UG/L AS ZN)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
NOV 14...	<10	2	<1	1.0	160	<6	8	67	2500	75
JAN 20...	--	--	--	--	--	--	--	29	399	99
MAR 17...	<10	4	<1	2.0	130	<6	<3	294	8890	97
MAY 11...	<10	3	<1	<1.0	320	<6	7	25	198	91
JUL 19...	--	--	--	--	--	--	--	32	182	96
SEP 14...	<10	2	<1	<1.0	120	<6	<3	61	784	95

442400084472801 HOUGHTON LAKE NEAR HOUGHTON LAKE HEIGHTS, MI

LOCATION.--Lat 44°24'16", long 84°47'28", in NW1/4 NW1/4 sec.10, T.23 N., R.4 W., Roscommon County, Hydrologic Unit 04060102, on right bank of Muskegon River at upstream side of bridge on Old U.S. Highway 27, 0.4 mi downstream from Houghton Lake, and 5.2 mi north of Houghton Lake Heights.

DRAINAGE AREA.--222 mi².

PERIOD OF RECORD.--June 1942 to current year, except winter period of 1942-43.

GAGE.--Water-stage recorder. Datum of gage is 1,130.00 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Sept. 28, 1960, nonrecording gage at datum 6.21 ft higher.

REMARKS.--Backus Creek and "The Cut" from Higgins Lake, join about 1 mi upstream from Houghton Lake and become the major inlet. There are also many small tributaries which feed the lake. The outlet is Muskegon River. Houghton Lake is the largest inland lake in Michigan covering 19,600 acres, with a maximum depth of 20 ft. Established legal level; summer, 1,138.1 ft, minimum winter, 1,137.6 ft, above NGVD.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 10.18 ft, Apr. 23, 1985; minimum observed, 6.95 ft, Sept. 3, 5, Nov. 8, 1958.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 9.29 ft, June 23; minimum, 7.80 ft, Sept. 22.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	8.16	8.16	8.91	8.81	8.55	8.30	8.71	9.09	9.01	9.03	8.52	8.36
2	8.13	8.12	8.91	8.80	8.54	8.29	8.75	9.05	9.01	9.02	8.46	8.35
3	8.16	8.18	8.82	8.79	8.53	8.29	8.77	9.05	9.01	9.01	8.49	8.38
4	8.15	8.17	8.89	8.79	8.52	8.32	8.82	9.11	8.98	8.98	8.58	8.42
5	8.10	8.21	8.92	8.78	8.51	8.33	8.89	9.08	9.02	8.99	8.63	8.34
6	8.12	8.53	8.93	8.77	8.50	8.33	8.93	9.01	9.00	8.96	8.51	8.35
7	8.12	8.44	8.89	8.76	8.50	8.32	8.96	8.95	8.98	8.91	8.52	8.36
8	8.12	8.46	8.89	8.77	8.48	8.31	8.99	8.99	9.00	8.89	8.55	8.33
9	8.11	8.51	8.90	8.77	8.47	8.30	9.00	9.00	9.03	8.89	8.56	8.35
10	8.01	8.53	8.91	8.76	8.46	8.28	9.02	8.96	8.96	8.83	8.56	8.34
11	8.00	8.58	8.90	8.75	8.45	8.27	9.03	8.93	9.05	8.85	8.57	8.36
12	8.02	8.72	8.90	8.74	8.44	8.26	9.05	8.93	9.07	8.83	8.56	8.31
13	8.04	8.68	8.89	8.72	8.43	8.26	9.04	8.98	9.05	8.81	8.55	8.33
14	8.06	8.66	8.88	8.72	8.43	8.25	9.09	8.96	9.03	8.77	8.56	8.34
15	8.05	8.76	8.86	8.71	8.42	8.28	9.08	8.95	9.02	8.77	8.53	8.34
16	8.10	8.87	8.86	8.69	8.40	8.30	9.08	8.95	9.03	8.76	8.52	8.33
17	8.11	8.72	8.84	8.68	8.39	8.30	9.03	8.95	9.05	8.75	8.53	8.33
18	8.08	8.77	8.83	8.67	8.38	8.33	9.06	8.96	9.08	8.74	8.54	8.34
19	8.19	8.84	8.82	8.67	8.37	8.35	9.05	8.99	9.12	8.71	8.53	8.35
20	8.20	8.78	8.82	8.65	8.36	8.35	9.11	8.93	9.14	8.69	8.51	8.33
21	8.23	8.75	8.82	8.65	8.36	8.35	9.13	8.90	9.15	8.69	8.46	8.33
22	8.14	8.82	8.81	8.64	8.35	8.34	9.15	8.95	9.16	8.66	8.50	8.21
23	8.23	8.84	8.83	8.62	8.34	8.34	9.16	8.94	9.18	8.66	8.46	8.09
24	8.17	8.85	8.82	8.61	8.33	8.33	9.15	8.94	9.12	8.65	8.47	8.28
25	8.18	8.83	8.81	8.60	8.33	8.34	9.14	8.97	9.13	8.63	8.46	8.26
26	8.18	8.84	8.80	8.60	8.32	8.35	9.14	8.88	9.12	8.61	8.45	8.16
27	8.27	8.91	8.84	8.59	8.31	8.37	9.13	8.81	9.09	8.57	8.42	8.24
28	8.12	8.88	8.85	8.58	8.31	8.43	9.15	8.89	9.03	8.56	8.44	8.24
29	8.13	8.93	8.84	8.57	---	8.54	9.13	8.89	9.07	8.57	8.43	8.17
30	8.17	8.93	8.84	8.57	---	8.62	9.09	8.90	9.05	8.58	8.38	8.22
31	8.22	---	8.82	8.56	---	8.67	---	9.00	---	8.54	8.43	---
MEAN	8.13	8.64	8.86	8.69	8.42	8.35	9.03	8.96	9.06	8.77	8.51	8.30
MAX	8.27	8.93	8.93	8.81	8.55	8.67	9.16	9.11	9.18	9.03	8.63	8.42
MIN	8.00	8.12	8.80	8.56	8.31	8.25	8.71	8.81	8.96	8.54	8.38	8.09

CAL YR 1988 MEAN 8.46 MAX 9.26 MIN 8.00
WTR YR 1989 MEAN 8.64 MAX 9.18 MIN 8.00

04121300 CLAM RIVER AT VOGEL CENTER, MI

LOCATION.--Lat 44°12'02", long 85°03'10", in SW1/4 NW1/4 sec.21, T.21 N., R.6 W., Missaukee County, Hydrologic Unit 04060102, on left bank 10 ft downstream from bridge on 8 Mile Road, 0.5 mi north of Vogel Center, and 3.5 mi southeast of Falmouth.

DRAINAGE AREA.--243 mi².

PERIOD OF RECORD.--June 1966 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 1,130 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 13-19, 29, 30, Jan. 1, 3, 4, 6-9, 11, 13, 14, 16, Feb. 4, 6, 11, 12, 15, 16, 19-22, 25-28, and Mar. 2, 3, 5-8, 19-21. Records good except for estimated daily discharges, which are poor. Some regulation at low flow by dams upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--23 years, 130 ft³/s, 7.26 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,710 ft³/s, Mar. 29, 1989, gage height, 7.31 ft; minimum, 29 ft³/s, Nov. 3, 1969, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 350 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Mar. 29	0900	*1,710	*7.31	June 2	0500	357	4.18

Minimum discharge, 63 ft³/s, Oct. 1, gage height, 2.49 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989 MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	68	97	245	155	149	99	535	171	312	136	83	74
2	76	97	218	151	137	95	354	168	345	119	82	72
3	84	95	209	145	127	95	337	163	258	102	81	72
4	86	94	196	142	128	93	357	160	180	92	119	70
5	86	112	198	140	128	95	401	160	153	92	109	70
6	82	211	189	140	127	98	400	157	157	94	111	70
7	76	291	188	140	125	100	333	155	160	90	106	75
8	73	281	183	142	122	105	282	153	158	85	101	81
9	72	210	164	144	119	109	257	150	157	83	102	87
10	74	214	151	146	118	113	234	142	157	82	100	92
11	81	239	147	146	118	116	219	133	162	78	96	100
12	90	222	147	146	118	125	217	130	159	77	100	102
13	94	193	145	145	118	125	218	129	158	76	99	100
14	91	194	145	140	117	123	221	131	156	75	97	103
15	84	197	145	139	115	167	224	132	137	76	96	104
16	87	222	145	138	112	167	223	134	129	75	92	102
17	105	252	145	136	109	139	219	126	160	73	84	98
18	144	265	145	138	106	110	214	119	187	72	77	96
19	165	241	145	138	105	115	206	119	218	74	74	93
20	136	223	156	138	105	122	198	132	266	76	75	91
21	112	217	193	137	104	130	193	125	268	75	75	90
22	110	208	199	132	104	133	188	114	230	72	77	89
23	115	197	186	137	103	140	184	102	199	73	86	89
24	132	188	179	137	103	138	180	95	182	71	89	89
25	156	181	175	138	100	164	179	110	169	69	84	90
26	149	182	169	135	100	259	182	129	160	68	76	89
27	129	238	139	133	100	543	181	112	152	69	74	86
28	117	298	144	132	99	1210	177	98	148	68	75	85
29	111	323	155	132	---	1680	173	91	144	70	79	85
30	105	287	155	133	---	1450	176	101	141	76	78	84
31	99	---	160	148	---	953	---	189	---	81	77	---
TOTAL	3189	6269	5260	4343	3216	9111	7462	4130	5562	2519	2754	2628
MEAN	103	209	170	140	115	294	249	133	185	81.3	88.8	87.6
MAX	165	323	245	155	149	1680	535	189	345	136	119	104
MIN	68	94	139	132	99	93	173	91	129	68	74	70
CFSM	.42	.86	.70	.58	.47	1.21	1.03	.55	.76	.34	.37	.36
IN.	.49	.96	.81	.66	.49	1.39	1.14	.63	.85	.39	.42	.40

CAL YR 1988 TOTAL 49180 MEAN 134 MAX 586 MIN 51 CFSM .55 IN 7.53
WTR YR 1989 TOTAL 56443 MEAN 155 MAX 1680 MIN 68 CFSM .64 IN 8.64

04121500 MUSKEGON RIVER AT EVART, MI

LOCATION.--Lat 43°53'57", long 85°15'19", in NW1/4 NE1/4 sec.3, T.17 N., R.8 W., Osceola County, Hydrologic Unit 04060102, on right bank 500 ft downstream from bridge on U.S. Highway 10 in Evart, 0.4 mi upstream from Twin Creek, and at mile 123.9.

DRAINAGE AREA.--1,450 mi², approximately.

PERIOD OF RECORD.--October 1930 to September 1931, October 1933 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1437: 1934, 1947(M).

GAGE.--Water-stage recorder. Datum of gage is 977.72 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 7, 1956, nonrecording gages at sites 400 ft and 500 ft upstream at present datum.

REMARKS.--Estimated daily discharges: Dec. 11-17, 19, Dec. 30 to Jan. 4, Jan. 7-11, 21, 22, 27, 28, Feb. 7-9, 11-18, 20-25, 27, 28, and Mar. 2, 6-9, 19-22. Records good except for estimated daily discharges, which are poor. Some regulation at low flow by dams upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--57 years, 1,016 ft³/s, 9.52 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 9,040 ft³/s, Mar. 31, 1989, gage height, 14.99 ft; minimum discharge observed, 164 ft³/s, Dec. 20, 1947, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 9,040 ft³/s, Mar. 31, gage height, 14.99 ft; minimum, 402 ft³/s, Aug. 3, 4, Sept. 6; minimum gage height, 6.71 ft, Sept. 28-30.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	466	1060	2370	1080	1380	741	7260	1180	2420	826	421	442
2	513	1030	2210	1040	1330	720	5630	1140	2610	779	413	435
3	513	1000	2100	1020	1090	708	4640	1090	2610	737	408	422
4	521	983	2010	1000	964	687	4160	1050	2470	694	431	415
5	557	1070	1930	1000	896	709	4090	1020	2030	654	581	410
6	569	1800	1850	998	813	720	3970	1010	1650	630	601	407
7	569	2240	1780	1000	810	740	3830	967	1460	613	604	428
8	573	2340	1700	1010	810	750	3560	937	1350	592	576	435
9	583	2380	1580	1020	810	760	3210	919	1270	577	560	464
10	582	2580	1410	1050	811	771	2900	895	1220	558	543	498
11	593	2680	1100	1080	805	795	2670	862	1130	539	529	500
12	609	2660	960	1120	805	847	2500	841	1070	519	520	488
13	616	2790	960	1130	805	906	2360	840	1060	507	541	498
14	642	2810	980	1100	800	977	2240	834	1020	500	523	516
15	637	2730	990	1050	800	1550	2160	808	1010	489	507	515
16	651	2810	1000	1050	790	1650	2070	795	1090	481	504	506
17	757	2850	1000	1010	780	1460	2020	780	1200	481	498	498
18	1120	2750	1010	997	775	1090	1990	767	1250	473	479	488
19	1180	2650	1000	985	775	1100	1930	773	1870	474	456	476
20	1140	2550	1210	971	760	1100	1840	814	2420	487	447	463
21	1090	2420	1380	970	760	1100	1760	819	2010	499	443	452
22	1070	2280	1390	965	760	1110	1690	796	1810	478	445	442
23	1060	2170	1430	964	755	1110	1620	767	1630	464	457	426
24	1160	2060	1480	962	750	1120	1550	733	1430	444	458	429
25	1310	1950	1430	953	750	1430	1480	801	1280	437	451	440
26	1330	1880	1370	963	755	2290	1460	864	1170	427	440	439
27	1270	2190	1260	965	750	3090	1420	843	1080	426	428	437
28	1220	2440	1200	975	745	4730	1360	813	1000	421	419	424
29	1180	2520	1140	992	---	6600	1290	782	928	413	446	422
30	1120	2520	1110	1060	---	8380	1230	861	865	422	462	421
31	1080	---	1100	1140	---	8770	---	1570	---	427	447	---
TOTAL	26281	66193	43440	31620	23634	58511	79890	27971	45413	16468	15038	13636
MEAN	848	2206	1401	1020	844	1887	2663	902	1514	531	485	455
MAX	1330	2850	2370	1140	1380	8770	7260	1570	2610	826	604	516
MIN	466	983	960	953	745	687	1230	733	865	413	408	407
CFSM	.59	1.52	.97	.70	.58	1.30	1.84	.62	1.04	.37	.33	.31
IN.	.67	1.70	1.11	.81	.61	1.50	2.05	.72	1.17	.42	.39	.35

CAL YR 1988 TOTAL 397701 MEAN 1087 MAX 4550 MIN 310 CFSM .75 IN 10.20
WTR YR 1989 TOTAL 448095 MEAN 1228 MAX 8770 MIN 407 CFSM .85 IN 11.50

04121900 LITTLE MUSKEGON RIVER NEAR MORLEY, MI

LOCATION.--Lat 43°30'09", long 85°20'33", in SW1/4 SW1/4 sec.24, T.13 N., R.9 W., Mecosta County, Hydrologic Unit 04060102, on right bank at upstream side of highway bridge on 130th Avenue, 0.5 mi downstream from Rustford Dam, and 5.2 mi east of Morley.

DRAINAGE AREA.--138 mi^2.

PERIOD OF RECORD.--October 1966 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 920 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 11, 16-18, 30, 31, Jan. 4, 5, 8-11, 14, Feb. 3-5, 7-13, 17-19, 23-25, 28, and Mar. 1-8, 18, 19. Records good except for estimated daily discharges, which are fair. Some regulation by dams upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--23 years, 130 ft^3/s, 12.79 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,300 ft^3/s, Sept. 12, 1986, gage height, 8.57 ft; minimum, 22 ft^3/s, July 21, 1979; minimum gage height, 1.51 ft, July 28, 1987.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 400 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Mar. 15	1300	*775	*4.98	May 31	0400	539	4.08
Mar. 29	0430	696	4.69				

Minimum discharge, 64 ft^3/s, Sept. 30; minimum gage height, 1.75 ft, July 26, 27, Aug. 4, Sept. 6.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	68	121	178	119	169	94	295	121	515	113	69	74
2	84	120	165	114	142	93	251	115	389	98	68	76
3	92	116	156	113	130	92	234	111	265	149	67	72
4	89	116	149	113	122	93	252	107	203	123	116	72
5	101	151	142	112	114	93	268	107	172	103	155	70
6	94	300	140	112	113	94	252	106	153	98	116	69
7	73	321	138	109	110	94	220	103	139	93	98	80
8	76	299	133	110	108	95	197	101	120	87	90	78
9	75	246	127	114	105	96	182	98	114	87	87	140
10	77	313	123	115	104	95	168	88	111	83	85	121
11	76	312	122	118	103	102	158	85	105	80	89	94
12	75	276	120	122	102	125	165	86	102	77	134	84
13	73	261	115	118	102	133	173	93	112	76	103	82
14	72	230	111	114	103	183	176	93	113	75	82	91
15	76	206	110	109	101	634	177	93	126	75	80	84
16	86	206	108	107	100	473	163	93	136	73	77	80
17	132	212	106	106	98	305	158	89	142	71	74	79
18	167	187	104	106	98	195	148	86	142	70	71	76
19	155	173	104	109	98	180	138	94	237	71	70	73
20	131	173	119	110	98	171	132	107	355	76	79	72
21	121	165	141	108	99	157	136	112	330	74	80	70
22	127	157	124	104	98	148	117	102	268	72	89	70
23	128	149	156	103	97	144	108	97	261	74	96	69
24	155	142	157	107	97	152	107	92	285	68	85	69
25	157	140	140	106	97	271	107	110	270	69	79	69
26	140	140	133	117	97	609	117	120	204	67	77	68
27	126	209	134	118	95	574	114	102	167	71	78	66
28	120	219	153	115	95	593	115	87	150	77	75	65
29	99	196	142	125	---	674	127	83	134	71	77	66
30	94	185	130	160	---	545	125	231	123	72	76	64
31	94	---	125	158	---	387	---	530	---	70	72	---
TOTAL	3233	6041	4105	3571	2995	7694	5080	3642	5943	2563	2694	2343
MEAN	104	201	132	115	107	248	169	117	198	82.7	86.9	78.1
MAX	167	321	178	160	169	674	295	530	515	149	155	140
MIN	68	116	104	103	95	92	107	83	102	67	67	64
CFSM	.75	1.46	.96	.83	.78	1.80	1.23	.85	1.44	.60	.63	.57
IN.	.87	1.63	1.11	.96	.81	2.07	1.37	.98	1.60	.69	.73	.63

CAL YR 1988 TOTAL 45029 MEAN 123 MAX 609 MIN 36 CFSM .89 IN 12.14
WTR YR 1989 TOTAL 49904 MEAN 137 MAX 674 MIN 64 CFSM .99 IN 13.45

04122000 MUSKEGON RIVER AT NEWAYGO, MI

LOCATION.--Lat 43°25'20", long 85°48'04", in NE1/4 NE1/4 sec.24, T.12 N., R.13 W., Newaygo County, Hydrologic Unit 04060102, on left bank near nonoperative powerplant in Newaygo, 600 ft downstream from Penoyer Creek, and at mile 39.1.

DRAINAGE AREA.--2,350 mi², approximately.

PERIOD OF RECORD.--July to December 1908, July 1909 to July 1915, January 1916 to December 1919, October 1930 to current year. Monthly discharge only for some periods, published in WSP 1307. Records for June 1901 to December 1906, published in WSP 129, 170, and 206, are unreliable and should not be used.

REVISED RECORDS.--WSP 974: 1933, 1935, 1937-38. WSP 1307: 1940(M). See also PERIOD OF RECORD.

GAGE.--Water-stage recorder. Datum of gage is 625.83 ft above National Geodetic Vertical Datum of 1929. October 1930 to January 1939, nonrecording gage, and Jan. 31, 1939 to Sept. 30, 1963, water-stage recorder at present site at datum 40.0 ft lower.

REMARKS.--No estimated daily discharges. Records good. Flow regulated by powerplants upstream from station, the largest of which are Croton Dam, Hardy Dam (since 1931), and Rogers Dam. Since Dec. 27, 1965, powerplant at Newaygo nonoperative, and in January 1969, dam at Newaygo was removed. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--67 years (water years 1910-14, 1917-19, 1931-89), 2,010 ft³/s, 11.62 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 23,200 ft³/s, Sept. 12, 1986, gage height, 19.54 ft, from floodmark; minimum, 52 ft³/s, Oct. 2, 1965, gage height, 5.31 ft, result of regulation during pipeline repair; minimum daily, 330 ft³/s, Feb. 15, 1914.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 8,290 ft³/s, Apr. 2, gage height, 11.83 ft; minimum, 1,030 ft³/s, July 29, 30, 31, Aug. 1, 2, Sept. 25, 26, 27; minimum gage height, 6.76 ft, July 29, 30, 31, Aug. 1, 2; minimum daily discharge, 1,030 ft, Sept. 26, 27.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1290	1830	4560	1960	2780	1790	7810	2140	6520	1810	1040	1140
2	1290	1830	4360	1970	2790	1780	8240	1790	5640	1810	1090	1160
3	1280	2040	4000	2190	2780	1800	8220	1790	4650	1820	1160	1150
4	1290	2330	3600	2430	2770	1800	7930	1790	4810	1820	2220	1160
5	1280	2430	3480	2420	2600	1780	7210	1770	4450	1800	2670	1170
6	1230	3100	3450	2320	2530	1570	6350	1750	3700	1560	2550	1130
7	1170	4490	3260	2330	2590	1330	5950	1750	3070	1230	1760	1160
8	1190	5260	3060	2370	2550	1500	5560	1730	2580	1400	1510	1200
9	1200	4380	2850	2340	2460	1790	5290	1730	2660	1450	1220	1200
10	1200	4510	2370	2460	2400	1820	4800	1710	2490	1100	1220	1200
11	1280	4920	1790	2750	2340	1820	3710	1690	2460	1150	1480	1190
12	1420	5180	1590	3020	2330	1820	3720	1680	2380	1220	1420	1190
13	1420	5080	1680	2990	2360	1830	3720	1680	2360	1230	1650	1200
14	1340	5000	1860	2940	2370	2070	3730	1680	2390	1230	1520	1350
15	1380	4890	1910	2910	2390	3100	3710	1680	1870	1220	1340	1650
16	1390	4620	1870	2890	2400	4570	3450	1670	2240	1210	1330	1730
17	1570	4420	1850	2880	2390	4600	3060	1630	2210	1150	1340	1620
18	2060	4420	1850	2780	2320	3850	3050	1640	2190	1360	1220	1480
19	2730	4520	2310	2680	2290	3050	3030	1710	2780	1580	1330	1320
20	2800	4480	2600	2710	2370	3100	3000	1770	4730	1200	1360	1330
21	2430	4060	2790	2710	2370	3190	2970	1760	4950	1190	1340	1330
22	2350	3760	2980	2660	2120	3140	2780	1750	3960	1190	1370	1330
23	2270	3510	3070	2660	1870	3380	2590	1750	3700	1180	1360	1200
24	2290	3070	3130	2610	1840	3080	2540	1730	3550	1180	1340	1040
25	2470	3280	3110	2560	1790	2670	2470	1770	3340	1180	1340	1040
26	2960	3500	2860	2560	1790	3370	2470	1830	2690	1180	1330	1030
27	2670	3650	2600	2550	1790	5840	2450	1860	2160	1490	1330	1030
28	2370	3810	2550	2550	1790	6570	2460	1860	2180	1430	1330	1040
29	2290	3860	2540	2560	---	7270	2460	1840	2000	1040	1330	1050
30	2330	4310	2280	2570	---	7720	2470	2760	1800	1040	1220	1050
31	2090	---	1960	2670	---	7660	---	5050	---	1040	1080	---
TOTAL	56330	116540	84170	80000	65170	100660	127200	58740	96510	41490	44800	36870
MEAN	1817	3885	2715	2581	2328	3247	4240	1895	3217	1338	1445	1229
MAX	2960	5260	4560	3020	2790	7720	8240	5050	6520	1820	2670	1730
MIN	1170	1830	1590	1960	1790	1330	2450	1630	1800	1040	1040	1030
CFSM	.77	1.65	1.16	1.10	.99	1.38	1.80	.81	1.37	.57	.62	.52
IN.	.89	1.84	1.33	1.27	1.03	1.59	2.01	.93	1.53	.66	.71	.58

CAL YR 1988 TOTAL 822248 MEAN 2247 MAX 6010 MIN 704 CFSM .96 IN 13.02
WTR YR 1989 TOTAL 908480 MEAN 2489 MAX 8240 MIN 1030 CFSM 1.06 IN 14.38

04122030 MUSKEGON RIVER NEAR BRIDGETON, MI
(National stream quality accounting network station)

LOCATION.--Lat 43°19'05", long 86°02'11", in SW1/4 NW1/4 sec.30, T.11 N., R.14 W., Newaygo County, Hydrologic Unit 04060102, at bridge on Maple Island Road, 5 mi southwest of Bridgeton, 13 mi upstream from Muskegon Lake, and 20 mi downstream from gaging station at Newaygo.

DRAINAGE AREA.--2,420 mi², approximately.

PERIOD OF RECORD.--Water years 1974 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: November 1974 to September 1981.
WATER TEMPERATURE: November 1974 to September 1981.

INSTRUMENTATION.--Water-quality monitor from Nov. 12, 1975 to Sept. 24, 1981.

REMARKS.--Quarterly cross-sectional samples were collected at or near bridge. Water-discharge measurements were made at time of sampling. Some regulation by upstream dams.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1975, 1978-81): Maximum, 1,550 microsiemens, Sept. 24, 1979; minimum, 69 microsiemens, May 3, 1979.
WATER TEMPERATURE (water years 1975, 1977-81): Maximum, 33.0°C, July 19, 1977; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
NOV										
01...	1345	1870	425	8.01	8.0	2.0	10.7	93	--	--
MAR										
29...	1200	6900	322	7.94	2.5	3.0	12.4	93	K18	310
MAY										
10...	1245	1720	274	8.05	12.5	1.0	10.1	97	K14	K7
SEP										
13...	1130	1200	371	8.22	18.5	1.4	8.4	91	49	K39

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
NOV										
01...	200	--	52	17	12	11	0.4	1.2	--	--
MAR										
29...	150	33	41	12	9.5	12	0.3	1.7	145	0
MAY										
10...	140	26	37	11	7.2	10	0.3	1.6	137	0
SEP										
13...	180	25	48	15	11	12	0.4	1.0	191	0

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
NOV										
01...	--	26	19	0.1	5.7	239	0.33	1210	0.02	0.37
MAR										
29...	119	20	14	0.1	7.2	189	0.26	3520	0.02	0.50
MAY										
10...	112	14	13	0.1	4.6	153	0.21	711	<0.01	0.30
SEP										
13...	157	19	18	0.1	5.9	228	0.31	739	<0.01	0.20

04122030 MUSKEGON RIVER NEAR BRIDGETON, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
NOV										
01...	0.05	0.04	2.9	0.02	0.01	<0.01	<10	<1	26	<0.5
MAR										
29...	0.17	0.13	0.60	0.05	0.02	0.01	40	1	24	<0.5
MAY										
10...	0.05	0.04	0.70	0.02	<0.01	<0.01	20	<1	25	<0.5
SEP										
13...	0.02	0.02	0.80	0.02	<0.01	<0.01	<10	1	17	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
NOV										
01...	<1	<1	<3	4	11	<5	4	6	<0.1	<10
MAR										
29...	<1	<1	<3	2	90	<5	<4	14	0.1	<10
MAY										
10...	<1	<1	<3	4	48	1	<4	6	0.2	<10
SEP										
13...	<1	1	<3	4	8	<1	5	4	0.1	20

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
NOV									
01...	4	<1	1.0	180	<6	9	22	111	21
MAR									
29...	3	<1	1.0	120	<6	22	79	1470	25
MAY									
10...	<1	<1	<1.0	110	<6	33	11	51	58
SEP									
13...	<1	<1	<1.0	160	<6	12	12	39	44

04122100 BEAR CREEK NEAR MUSKEGON, MI

LOCATION.--Lat 43°17'19", long 86°13'22", in SW1/4 NW1/4 sec.4, T.10 N., R.16 W., Muskegon County, Hydrologic Unit 04060102, on left bank at upstream side of bridge on North Getty Street, 1.5 mi upstream from Little Bear Creek, and 3.9 mi northeast of Muskegon.

DRAINAGE AREA.--14.8 mi².

PERIOD OF RECORD.--October 1965 to current year.

REVISED RECORDS.--WDR MI-80-1: 1976(M), 1978(M), 1979(P).

GAGE.--Water-stage recorder. Datum of gage is 590.00 ft above National Geodetic Vertical Datum of 1929 (Michigan Department of Natural Resources bench mark). Prior to Mar. 17, 1978, at different datum.

REMARKS.--Estimated daily discharges: Dec. 12, 13, 17, Jan. 4, 5, 8-13, Feb. 4-11, 17-19, 23-25, and Mar. 1-9, 18. Records good except for estimated daily discharges, which are poor. Some regulation during low flow by dams and irrigation upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--24 years, 17.3 ft³/s, 15.87 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 930 ft³/s, Mar. 5, 1976, gage height, 11.00 ft, datum then in use; minimum, 1.0 ft³/s, Aug. 5, 17, 22, 1971.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 100 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Nov. 16	1930	*123	*14.10	No other peak greater than base discharge.			

Minimum discharge, 2.9 ft³/s, Aug. 1, 3, 4, gage height, 10.33 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	5.6	16	33	23	26	15	32	14	53	7.2	3.4	8.9
2	7.0	15	29	22	21	14	30	14	41	6.6	3.3	7.8
3	6.0	15	29	21	21	14	28	13	31	6.6	3.3	6.7
4	7.3	17	25	21	19	15	30	13	28	6.2	16	6.0
5	7.9	33	24	20	18	15	29	13	23	6.1	15	5.4
6	6.4	57	23	19	18	15	26	12	20	5.7	9.9	6.6
7	5.9	60	22	20	17	15	25	12	19	5.6	8.3	7.9
8	5.7	39	20	20	17	15	24	11	17	5.1	7.2	7.3
9	5.5	32	19	21	17	15	23	11	15	5.5	6.4	7.4
10	5.4	52	19	21	16	15	22	11	15	5.0	6.0	7.0
11	6.0	48	18	21	16	19	21	9.9	13	4.8	5.8	6.2
12	6.2	34	18	22	16	23	22	9.9	14	5.1	5.1	5.8
13	5.9	43	18	22	16	26	20	11	16	5.1	4.8	6.9
14	5.8	36	18	23	16	30	21	10	15	5.6	5.5	6.9
15	5.6	31	20	22	16	53	20	9.8	14	4.8	5.6	6.1
16	9.4	88	19	21	15	38	19	9.5	13	5.1	5.0	5.6
17	11	69	18	20	15	32	20	9.4	13	4.5	4.4	5.4
18	15	39	18	21	15	31	20	8.9	12	4.7	4.2	5.0
19	15	34	18	23	15	29	19	9.3	18	6.4	4.5	4.6
20	14	34	37	24	15	27	18	10	18	6.0	6.1	4.5
21	18	30	52	21	15	25	18	9.4	14	5.9	5.4	4.2
22	21	27	33	20	15	24	17	8.4	13	5.6	21	4.2
23	20	25	41	21	15	24	16	7.9	12	4.6	15	4.4
24	28	24	37	22	15	33	15	7.8	11	4.1	11	4.5
25	26	23	30	22	15	56	16	13	9.5	4.1	9.4	4.7
26	22	25	24	28	15	58	16	11	9.0	3.8	8.0	4.4
27	19	46	29	25	14	48	15	9.4	9.5	4.2	7.4	4.2
28	25	41	42	23	15	49	15	8.5	8.7	4.2	7.5	4.2
29	20	34	32	24	---	62	16	8.3	7.8	3.8	7.7	3.6
30	17	34	28	30	---	43	15	44	7.8	4.3	6.9	3.5
31	16	---	25	28	---	36	---	75	---	4.0	5.9	---
TOTAL	388.6	1101	818	691	464	914	628	424.4	510.3	160.3	235.0	169.9
MEAN	12.5	36.7	26.4	22.3	16.6	29.5	20.9	13.7	17.0	5.17	7.58	5.66
MAX	28	88	52	30	26	62	32	75	53	7.2	21	8.9
MIN	5.4	15	18	19	14	14	15	7.8	7.8	3.8	3.3	3.5
CFSM	.85	2.48	1.78	1.51	1.12	1.99	1.41	.93	1.15	.35	.51	.38
IN.	.98	2.77	2.06	1.74	1.17	2.30	1.58	1.07	1.28	.40	.59	.43

CAL YR 1988 TOTAL 7149.2 MEAN 19.5 MAX 109 MIN 2.5 CFSM 1.32 IN 17.97
WTR YR 1989 TOTAL 6504.5 MEAN 17.8 MAX 88 MIN 3.3 CFSM 1.20 IN 16.35

04122200 WHITE RIVER NEAR WHITEHALL, MI

LOCATION.--Lat 43°27'51", long 86°13'57", in SE1/4 NW1/4 sec.4, T.12 N., R.16 W., Muskegon County, Hydrologic Unit 04060101, on right bank 30 ft downstream from bridge on Fruitvale Road, 6.3 mi downstream from North Branch, and 6.9 mi northeast of Whitehall.

DRAINAGE AREA.--406 mi².

PERIOD OF RECORD.--August 1957 to current year.

REVISED RECORDS.--WDR MI-83: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 594.1 ft above National Geodetic Vertical Datum of 1929. Nov. 18, 1957, to Oct. 22, 1958, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 13-20, Dec. 29 to Jan. 17, Feb. 6-16, 18-23, and Feb. 25 to Mar. 10. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--32 years, 447 ft³/s, 14.95 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,400 ft³/s, Sept. 1, 1975, gage height, 7.46 ft; minimum, 163 ft³/s, Aug. 18, 19, 1958.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,260 ft³/s, June 1, gage height, 6.08 ft; minimum, 232 ft³/s, Sept. 30; minimum gage height, 1.56 ft, Aug. 4.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	277	460	873	520	654	405	1210	463	2160	393	254	285
2	305	443	854	510	653	405	1030	454	1750	375	245	292
3	318	425	791	500	593	400	918	439	1430	362	240	280
4	314	421	725	490	517	400	843	423	1220	355	348	288
5	326	488	673	480	488	400	797	420	1030	343	505	286
6	323	628	628	480	470	400	770	414	911	330	574	280
7	304	826	597	490	460	405	731	409	790	320	550	302
8	292	1030	577	500	450	405	698	405	671	303	499	307
9	285	932	555	510	450	410	649	402	579	302	397	310
10	282	893	534	520	440	430	609	395	522	296	354	322
11	291	932	513	530	440	458	582	379	485	286	330	306
12	304	970	489	530	440	461	569	371	460	292	310	289
13	303	886	520	540	430	496	568	373	465	287	300	284
14	294	853	550	540	430	537	566	379	484	285	289	303
15	287	848	560	530	420	614	570	381	485	284	283	300
16	298	834	560	530	410	765	565	374	487	289	277	285
17	348	981	570	530	405	801	556	366	490	279	271	274
18	433	1100	580	525	400	730	546	360	508	273	261	270
19	513	948	630	500	400	644	535	365	514	282	255	263
20	514	863	700	502	400	640	517	396	502	302	278	254
21	484	813	771	498	400	598	503	413	557	297	315	249
22	467	755	945	478	400	526	485	402	709	292	327	247
23	472	695	866	482	390	503	474	376	975	284	357	240
24	500	644	813	488	378	510	461	354	919	272	343	239
25	565	604	818	503	390	568	453	393	779	262	310	243
26	603	582	747	521	400	802	467	471	642	257	297	243
27	589	617	697	556	410	1300	471	456	541	259	285	239
28	560	754	668	546	410	1430	469	411	482	274	279	240
29	544	921	610	540	---	1790	474	382	444	268	286	240
30	528	885	570	576	---	1730	473	581	417	264	289	236
31	493	---	540	633	---	1410	---	1070	---	260	282	---
TOTAL	12416	23031	20524	16078	12528	21373	18559	13277	22408	9227	10190	8196
MEAN	401	768	662	519	447	689	619	428	747	298	329	273
MAX	603	1100	945	633	654	1790	1210	1070	2160	393	574	322
MIN	277	421	489	478	378	400	453	354	417	257	240	236
CFSM	.99	1.89	1.63	1.28	1.10	1.70	1.53	1.05	1.84	.73	.81	.67
IN.	1.14	2.11	1.88	1.47	1.15	1.96	1.70	1.22	2.05	.85	.93	.75

CAL YR 1988 TOTAL 176272 MEAN 482 MAX 1100 MIN 213 CFSM 1.19 IN 16.15
WTR YR 1989 TOTAL 187807 MEAN 515 MAX 2160 MIN 236 CFSM 1.27 IN 17.21

04122500 PERE MARQUETTE RIVER AT SCOTTVILLE, MI

LOCATION.--Lat 43°56'42", long 86°16'43", in NW1/4 NW1/4 sec.19, T.18 N., R.16 W., Mason County, Hydrologic Unit 04060101, on right bank 20 ft upstream from highway bridge at south edge of Scottville, 1.4 mi upstream from India Creek, and 5.6 mi downstream from Big South Branch.

DRAINAGE AREA.--681 mi^2.

PERIOD OF RECORD.--August 1939 to current year. Prior to October 1942, published as "at Custer".

REVISED RECORDS.--WSP 1437: 1941(M), 1943(M), 1949(M), 1950. WDR MI-81: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 597.66 ft above National Geodetic Vertical Datum of 1929. Prior to June 12, 1943, nonrecording gage at bridge 4.5 mi upstream at different datum.

REMARKS.--Estimated daily discharges: Dec. 12, 14-20, Dec. 29 to Jan. 16, Feb. 2-4, 6-16, 19-22, 25-27, and Mar. 2-10. Records good except for estimated daily discharges, which are poor. Some regulation at low flow. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--50 years, 693 ft^3/s, 13.82 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,440 ft^3/s, Sept. 13, 1986, gage height, 8.07 ft; minimum, 209 ft^3/s, Dec. 11, 1962, discharge measurement; minimum daily, 310 ft^3/s, Aug. 9, 10, 1941.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,110 ft^3/s, Mar. 30, gage height, 5.92 ft; minimum, 437 ft^3/s, Sept. 30, gage height, 1.71 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	488	883	1620	870	1020	682	2480	783	1540	656	479	467
2	529	849	1490	840	1000	680	2080	762	2080	632	467	467
3	547	813	1400	830	930	670	1790	745	2320	615	461	466
4	554	793	1330	820	850	670	1610	731	2130	594	530	460
5	547	851	1250	790	825	660	1480	719	1830	577	623	451
6	537	1140	1190	800	800	660	1410	710	1590	563	755	448
7	523	1340	1120	820	790	670	1370	707	1420	551	814	451
8	506	1430	1070	830	790	670	1290	701	1250	538	718	477
9	495	1490	1030	840	780	680	1200	692	1130	526	624	516
10	494	1590	983	850	770	700	1120	679	1020	518	586	550
11	523	1540	937	860	770	743	1050	665	920	510	558	533
12	530	1510	870	880	760	766	996	654	852	509	535	509
13	537	1520	827	880	760	813	957	648	824	505	517	501
14	524	1490	900	880	750	852	947	653	812	500	507	510
15	509	1400	920	870	750	995	939	656	827	496	516	521
16	515	1450	930	870	730	1060	930	648	899	489	502	503
17	543	1520	940	872	718	1090	929	640	1030	484	490	485
18	663	1600	940	852	719	1070	922	634	1090	478	479	477
19	767	1670	960	845	715	1020	923	636	1110	491	471	472
20	842	1610	1000	832	710	955	907	662	1070	512	488	460
21	882	1450	1100	821	705	940	875	710	1010	518	503	453
22	844	1340	1240	793	705	883	847	717	1030	502	513	448
23	803	1270	1280	793	708	835	829	687	1040	491	512	450
24	887	1200	1250	816	664	851	810	650	992	509	519	445
25	975	1130	1220	819	660	931	791	692	950	492	503	444
26	1040	1080	1230	840	670	1220	808	719	889	474	484	446
27	1090	1200	1160	860	680	1690	807	792	819	482	473	446
28	1100	1360	1140	863	683	2050	820	780	763	508	470	445
29	1050	1530	1000	862	---	2510	808	712	721	525	474	443
30	989	1660	950	893	---	3000	792	801	685	506	476	440
31	937	---	920	950	---	2950	---	1100	---	492	475	---
TOTAL	21770	39709	34197	26241	21412	33966	33517	22085	34643	16243	16522	14184
MEAN	702	1324	1103	846	765	1096	1117	712	1155	524	533	473
MAX	1100	1670	1620	950	1020	3000	2480	1100	2320	656	814	550
MIN	488	793	827	790	660	660	791	634	685	474	461	440
CFSM	1.03	1.94	1.62	1.24	1.12	1.61	1.64	1.05	1.70	.77	.78	.70
IN.	1.19	2.17	1.87	1.43	1.17	1.86	1.83	1.21	1.89	.89	.90	.77

CAL YR 1988 TOTAL 291891 MEAN 798 MAX 1670 MIN 403 CFSM 1.17 IN 15.94
WTR YR 1989 TOTAL 314489 MEAN 862 MAX 3000 MIN 440 CFSM 1.27 IN 17.18

04124000 MANISTEE RIVER NEAR SHERMAN, MI

LOCATION.--Lat 44°26'11", long 85°41'55", in NE1/4 NE1/4 sec.36, T.24 N., R.12 W., Wexford County, Hydrologic Unit 04060103, on downstream side of bridge near right pier on State Highway 37, 250 ft upstream from Wheeler Creek, 0.9 mi north of Sherman, and at mile 60.8.

DRAINAGE AREA.--857 mi².

PERIOD OF RECORD.--July 1903 to May 1916, October 1930 to September 1931, October 1933 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1004: 1936(M). WSP 1307: 1911, 1913-14(M), 1934(M), 1936(M), 1937, 1939-40(M). WSP 1437: 1911, 1913(M), 1937. WDR MI-88: Drainage area.

GAGE.--Nonrecording gage and since May 1988 crest-stage gage at downstream side of bridge. Elevation of gage is 804 ft, from river profile map. Prior to Apr. 13, 1934, at various datums.

REMARKS.--Estimated daily discharges: Nov. 13-17, Dec. 12-17, 25, Jan. 1-3, 5-10, 12-15, Feb. 5-16, Feb. 19 to Mar. 4, Mar. 6-12, Aug. 25, 29, and Sept. 4. Records fair except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--69 years (water years 1904-15, 1931, 1934-89), 1,060 ft³/s, 16.80 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,570 ft³/s, Mar. 25, 1913, gage height, 7.1 ft, from graph based on gage readings, datum then in use; minimum daily, 540 ft³/s, Feb. 21-23, 1936.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,860 ft³/s, Mar. 29, gage height, 15.52 ft; minimum observed, 784 ft³/s, Oct. 1, gage height, 10.92 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	784	1120	1540	1100	1050	820	2450	1090	2570	1030	830	881
2	884	1040	1440	1040	1070	820	2190	1070	2120	1010	821	854
3	898	1020	1370	980	1010	820	2060	1060	1940	998	824	836
4	942	1050	1340	954	872	825	2040	1050	1740	938	872	820
5	926	1070	1310	940	900	827	2120	1050	1430	946	1060	827
6	902	1230	1290	940	900	830	2160	1030	1270	930	950	818
7	878	2080	1250	950	900	840	2140	1010	1180	910	884	818
8	845	2040	1230	960	900	850	2090	1000	1130	902	860	851
9	836	2000	1200	970	890	860	1840	994	1120	887	869	906
10	845	1980	1160	980	880	880	1660	982	1210	884	851	1070
11	860	1900	1150	998	870	910	1520	966	1210	878	842	1070
12	898	1820	1120	1000	870	970	1450	958	1210	872	857	1000
13	950	1810	1140	1010	860	1040	1420	966	1160	860	887	938
14	910	1780	1160	1020	850	1050	1410	970	1140	854	857	910
15	875	1760	1180	1030	860	1160	1410	962	1150	845	866	890
16	848	1790	1180	1040	860	1250	1390	974	1350	845	860	869
17	860	1860	1190	1030	866	1190	1380	970	2040	842	851	851
18	938	1840	1190	1030	830	1120	1370	1010	1980	836	839	842
19	1090	1750	1370	1030	820	1130	1340	1050	1620	984	830	839
20	1070	1680	1450	1030	815	1090	1330	1110	1500	887	821	830
21	1070	1690	1440	1020	815	1070	1290	1120	1370	872	836	824
22	1020	1680	1330	1010	810	1040	1270	1070	1310	860	854	818
23	1050	1420	1280	1000	810	1010	1250	1030	1280	851	848	821
24	1110	1340	1280	1020	810	1040	1200	994	1380	842	851	830
25	1120	1310	1250	1010	800	1110	1180	1110	1500	830	830	821
26	1150	1290	1210	1030	800	1290	1170	1160	1400	821	815	815
27	1190	1420	1200	1020	810	1920	1160	1170	1270	845	809	809
28	1230	1820	1190	1010	815	2640	1140	1110	1180	845	806	809
29	1210	1700	1180	1010	---	2800	1120	1070	1110	830	880	800
30	1150	1620	1170	1020	---	2710	1110	1040	1070	842	954	798
31	1170	---	1150	1030	---	2580	---	2000	---	833	918	---
TOTAL	30509	47910	38940	31212	24343	38492	46660	33146	42940	27309	26732	25865
MEAN	984	1597	1256	1007	869	1242	1555	1069	1431	881	862	862
MAX	1230	2080	1540	1100	1070	2800	2450	2000	2570	1030	1060	1070
MIN	784	1020	1120	940	800	820	1110	958	1070	821	806	798
CFSM	1.15	1.86	1.47	1.18	1.01	1.45	1.81	1.25	1.67	1.03	1.01	1.01
IN.	1.32	2.08	1.69	1.35	1.06	1.67	2.03	1.44	1.86	1.19	1.16	1.12

CAL YR 1988 TOTAL 398567 MEAN 1089 MAX 2480 MIN 764 CFSM 1.27 IN 17.30
WTR YR 1989 TOTAL 414058 MEAN 1134 MAX 2800 MIN 784 CFSM 1.32 IN 17.97

04126000 MANISTEE RIVER NEAR MANISTEE, MI

LOCATION.--Lat 44°16'14", long 86°11'56", in NW1/4 NW1/4 sec.36, T.22 N., R.16 W., Manistee County, Hydrologic Unit 04060103, on right bank 6.4 mi northeast of Manistee, 7.8 mi upstream from Manistee Lake, and at mile 10.8.

DRAINAGE AREA.--1,677 mi².

PERIOD OF RECORD.--October 1951 to current year. Monthly discharge only for October, November, 1951, published in WSP 1727.

REVISED RECORDS.--WDR MI-88: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 585 ft, from river-profile map.

REMARKS.--Estimated daily discharges: Mar. 1-9. Records good except for estimated daily discharges, which are fair. Flow regulated at all stages by Tippy Hydroelectric Powerplant 21 mi upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--38 years, 2,044 ft³/s, 16.55 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,280 ft³/s, Oct. 5, 1986, gage height, 8.44 ft; maximum gage height, 9.25 ft, Dec. 28, 1985, backwater from ice; minimum daily discharge, 570 ft³/s, June 18, 1980.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 6,890 ft³/s, Mar. 30, gage height, 8.56 ft; maximum gage height, 8.71 ft, Mar. 4, 5, backwater from ice; minimum discharge, 1,090 ft³/s, July 24, gage height, 4.46 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1540	2250	4030	2320	2060	1850	5770	1710	3940	1930	1560	1690
2	1760	2270	3610	2220	2050	1850	5010	2130	5730	2010	1830	1700
3	1910	2140	3140	2110	2130	1800	4200	2120	6020	2020	1640	1630
4	1750	2030	2680	2590	2020	1800	4180	1950	4910	1720	1840	1670
5	2040	2210	2560	2050	2140	1350	4150	2110	3920	1810	2260	1680
6	1920	2930	2530	1820	1450	1500	4100	2090	3480	1730	1930	1700
7	1810	3570	2840	1920	1750	1700	4100	1960	2570	1780	2000	2220
8	1660	4330	2780	2700	1990	1850	4020	1760	2370	1770	1590	2120
9	1670	4440	2480	2800	2460	2100	4070	1960	2320	1770	1840	2290
10	1750	4620	1920	2720	2240	2430	3600	2060	2210	1470	1660	2630
11	1800	4380	2510	2390	1860	2070	3350	2070	2430	1710	1670	2470
12	1710	4210	2480	2020	1650	2080	3160	1960	2290	1770	1670	2200
13	1960	4140	1410	2020	2040	2140	2710	1730	2260	1770	1400	1830
14	1780	4080	1600	2550	2350	2260	2800	1660	2230	1720	1720	2070
15	1700	3690	2230	2010	2210	2280	2900	1720	2190	1610	1690	1840
16	1820	3720	2630	2270	1930	2270	2820	1840	2290	1620	1690	1830
17	1670	3940	2500	2000	2060	2680	2560	2070	3300	1570	1650	1830
18	2170	4090	1830	2070	1740	2530	2840	1660	3840	1590	1710	1820
19	2180	4310	2140	2350	1640	2400	2820	1870	4140	1670	1620	1670
20	2100	4030	2490	2000	1930	2210	2710	2260	4250	1750	1570	1490
21	2210	3470	3130	1970	2060	2130	2540	2190	3870	1810	1650	1550
22	2250	3100	2920	1910	1980	2170	2460	2140	3280	1740	1580	1560
23	2050	2910	3190	2140	1880	2020	2170	1930	2650	1570	1670	1660
24	2120	3030	2960	1970	1830	2060	2240	2120	2330	1510	1660	1610
25	2610	2750	2710	1980	1730	2320	2250	2090	2420	1800	1560	1580
26	2940	2620	2300	2020	2020	2450	2270	2560	2350	1720	1620	1440
27	2730	2810	2600	2130	1770	2940	2250	2190	2540	1650	1630	1510
28	2770	3170	2830	1980	1850	3780	2420	2110	2340	1670	1580	1580
29	2630	3690	2350	2010	---	5660	2450	1900	2050	1830	1460	1590
30	2520	4030	2170	2050	---	6800	2330	2080	1910	1480	2090	1600
31	2420	---	2450	2160	---	6520	---	3080	---	1570	1580	---
TOTAL	63950	102960	80200	67250	54820	80000	95250	63080	92430	53140	52620	54060
MEAN	2063	3432	2587	2169	1958	2581	3175	2035	3081	1714	1697	1802
MAX	2940	4620	4030	2800	2460	6800	5770	3080	6020	2020	2260	2630
MIN	1540	2030	1410	1820	1450	1350	2170	1660	1910	1470	1400	1440
CFSM	1.23	2.05	1.54	1.29	1.17	1.54	1.89	1.21	1.84	1.02	1.01	1.08
IN.	1.42	2.28	1.78	1.49	1.22	1.77	2.11	1.40	2.05	1.18	1.17	1.20

CAL YR 1988 TOTAL 805860 MEAN 2202 MAX 4620 MIN 1160 CFSM 1.31 IN 17.88

WTR YR 1989 TOTAL 859760 MEAN 2356 MAX 6800 MIN 1350 CFSM 1.41 IN 19.07

04126520 MANISTEE RIVER AT MANISTEE, MI
(National stream quality accounting network station)

LOCATION.--Lat 44°15'02", long 86°19'09", in SW1/4 SW1/4 sec.1, T.21 N., R.17 W., Manistee County, Hydrologic Unit 04060103, at upstream side of bridge on U.S. Highway 31 in Manistee, and 1.3 mi upstream from mouth.

DRAINAGE AREA.--1,928 mi², revised.

PERIOD OF RECORD.--Water years 1974 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: November 1974 to September 1981.
WATER TEMPERATURE: November 1974 to September 1981.

INSTRUMENTATION.--Water-quality monitor from Mar. 18, 1977 to Sept. 30, 1981.

REMARKS.--Bimonthly cross-sectional samples were collected at Washington Street bridge. Water-discharge measurements were made at time of sampling.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1975-81): Maximum daily, 1,680 microsiemens, Nov. 18, 1974; minimum, 226 microsiemens, Apr. 22, 1980.
WATER TEMPERATURE (water years 1975-81): Maximum, 26.5°C, July 8, 1981, minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
NOV 02...	1400	2940	--	8.22	6.0	5.0	11.0	90	--	--
JAN 06...	0945	1820	390	8.03	0.5	3.7	12.8	91	K10	K9
MAR 30...	1000	6760	308	7.87	0.5	6.6	--	--	K130	K53
MAY 11...	0930	2000	387	8.09	11.5	2.1	10.5	97	K9	K5
JUN 22...	1130	2750	357	8.00	19.5	4.4	7.1	79	70	60
SEP 12...	1430	3560	419	8.18	18.5	3.0	7.9	86	140	64

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
NOV 02...	190	38	53	13	8.5	9	0.3	1.2	180	0
JAN 06...	180	42	51	12	9.1	10	0.3	1.2	165	0
MAR 30...	140	29	41	10	7.8	10	0.3	1.0	140	0
MAY 11...	180	45	53	12	11	12	0.4	1.3	167	0
JUN 22...	170	29	49	11	6.5	10	0.3	1.2	169	0
SEP 12...	200	48	57	13	12	12	0.4	1.2	180	0

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
NOV 02...	148	17	23	0.1	8.0	215	0.29	1710	0.01	0.23
JAN 06...	135	17	29	0.1	8.6	213	0.29	1050	<0.01	0.28
MAR 30...	115	15	17	0.1	7.2	186	0.25	3390	0.01	0.34
MAY 11...	137	13	33	0.1	6.9	214	0.29	1160	<0.01	0.19
JUN 22...	139	11	25	0.1	7.8	208	0.28	1540	<0.01	0.14
SEP 12...	148	13	35	0.1	7.8	229	0.31	2200	<0.01	0.14

04126520 MANISTEE RIVER AT MANISTEE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
NOV										
02...	0.05	0.04	0.70	0.02	0.01	<0.01	<10	<1	19	<0.5
JAN										
06...	0.05	0.05	0.30	0.02	<0.01	<0.01	--	--	--	--
MAR										
30...	0.08	0.03	0.50	0.04	0.01	<0.01	20	<1	17	<0.5
MAY										
11...	0.04	0.04	0.40	0.01	<0.01	<0.01	10	<1	25	<0.5
JUN										
22...	0.04	0.04	0.50	0.02	0.02	0.02	--	--	--	--
SEP										
12...	0.05	0.04	0.30	0.02	0.01	<0.01	<10	<1	37	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
NOV										
02...	<1	<1	<3	1	26	<5	10	5	<0.1	<10
JAN										
06...	--	--	--	--	--	--	--	--	--	--
MAR										
30...	<1	<1	<3	<1	77	<5	6	37	0.1	<10
MAY										
11...	<1	<1	<3	2	32	1	13	4	<0.1	<10
JUN										
22...	--	--	--	--	--	--	--	--	--	--
SEP										
12...	<1	<1	<3	1	11	<1	15	5	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
NOV									
02...	<1	<1	1.0	230	<6	7	13	103	78
JAN									
06...	--	--	--	--	--	--	8	39	65
MAR									
30...	<1	<1	<1.0	160	<6	11	19	347	86
MAY									
11...	<1	<1	<1.0	280	<6	18	6	32	75
JUN									
22...	--	--	--	--	--	--	11	82	95
SEP									
12...	<1	<1	<1.0	320	<6	15	8	77	89

04127000 BOARDMAN RIVER NEAR MAYFIELD, MI

LOCATION.--Lat 44°38'18", long 85°31'10", in SE1/4 NE1/4 sec.21, T.26 N., R.10 W., Grand Traverse County, Hydrologic Unit 04060105, on right bank 25 ft downstream from Brown's Bridge, 300 ft downstream from East Creek, 0.9 mi downstream from Brown's Bridge Dam, 1.0 mi northeast of Mayfield, and 9.6 mi southeast of Traverse City.

DRAINAGE AREA.--182 mi^2.

PERIOD OF RECORD.--June 1952 to current year.

REVISED RECORDS.--WDR MI-83: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 757.89 ft above National Geodetic Vertical Datum of 1929 (Traverse City light and Power bench mark).

REMARKS.--No estimated daily discharges. Records good. Flow regulated by hydroelectric powerplant 0.9 mi upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--37 years, 197 ft^3/s, 14.70 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,220 ft^3/s, Sept. 14, 1961, gage height, 6.90 ft; minimum, 30 ft^3/s, Jan. 15, 1965, gage height, 2.53 ft; minimum daily, 47 ft^3/s, Nov. 2, 3, 1963.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 691 ft^3/s, Mar. 27, gage height, 5.44 ft; minimum, 113 ft^3/s, Sept. 29, 30; minimum gage height, 3.09 ft, June 22; minimum daily discharge, 136 ft^3/s, July 26.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	176	211	283	224	209	169	391	226	529	197	185	185
2	203	211	277	225	202	174	350	228	371	194	191	140
3	213	209	252	215	211	197	368	216	370	185	189	167
4	237	201	276	188	184	180	417	207	250	185	195	166
5	184	223	242	229	176	184	402	214	249	185	192	163
6	174	483	271	214	212	182	434	215	271	185	188	163
7	187	457	223	223	197	184	391	246	215	183	143	159
8	185	393	243	196	202	188	334	211	209	183	165	160
9	189	367	263	232	178	194	321	211	274	149	184	187
10	188	390	229	226	183	185	313	210	251	188	184	214
11	204	329	210	188	199	188	242	208	243	181	183	160
12	205	362	231	212	203	190	308	207	228	177	180	175
13	201	312	240	209	178	189	279	207	233	165	179	179
14	195	307	236	209	188	198	290	207	230	170	181	178
15	192	323	203	209	189	272	243	207	227	186	185	169
16	190	332	192	207	186	207	312	207	338	149	182	155
17	195	370	274	221	189	225	276	205	342	174	183	171
18	204	275	194	200	182	218	286	203	310	183	184	175
19	206	354	241	196	195	188	282	235	304	191	183	162
20	193	289	258	204	195	188	257	244	231	187	151	162
21	216	240	271	207	190	207	247	267	229	183	164	161
22	216	285	273	208	176	202	264	221	227	183	184	164
23	221	248	270	195	159	207	215	254	234	170	187	164
24	253	278	255	203	189	205	261	204	324	164	185	163
25	254	243	255	207	197	220	226	306	236	182	181	160
26	262	240	238	210	175	268	253	270	222	136	145	159
27	284	339	250	193	177	398	206	262	232	188	162	160
28	268	355	236	235	209	592	264	208	190	187	186	157
29	230	374	225	189	---	522	228	228	187	185	194	145
30	224	277	228	192	---	511	232	218	206	160	189	148
31	218	---	224	232	---	492	---	489	---	161	187	---
TOTAL	6567	9277	7563	6500	5330	7724	8892	7241	7962	5496	5571	4971
MEAN	212	309	244	210	190	249	296	234	265	177	180	166
MAX	284	483	283	235	212	592	434	489	529	197	195	214
MIN	174	201	192	188	159	169	206	203	187	136	143	140
CFSM	1.17	1.70	1.34	1.15	1.04	1.37	1.63	1.29	1.46	.97	.99	.91
IN.	1.34	1.90	1.55	1.33	1.09	1.58	1.82	1.48	1.63	1.12	1.14	1.02

CAL YR 1988 TOTAL 80080 MEAN 219 MAX 508 MIN 119 CFSM 1.20 IN 16.37
WTR YR 1989 TOTAL 83094 MEAN 228 MAX 592 MIN 136 CFSM 1.25 IN 16.98

445256085240001 ELK LAKE NEAR ELK RAPIDS, MI

LOCATION.--Lat 44°50'43", long 85°23'33", in SW1/4 SW1/4 sec.3, T.28 N., R.9 W., Grand Traverse County, Hydrologic Unit 04060105, at Gay Road, 3.5 mi south of Elk Rapids.

DRAINAGE AREA.--410 mi^2, approximately.

PERIOD OF RECORD.--October 1951 to current year.

GAGE.--Water-stage recorder. Datum of gage is 586.25 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to June 20, 1952, nonrecording gage at same datum.

REMARKS.--Elk Lake is at the end of a long chain of interconnected lakes and is contiguous with Lake Skegemog. The major inlet to these lakes is Torch River. Smaller inlets include Williamsburg, Battle, Barker, and Desmond Creeks. The outlet of Elk Lake is Elk River. Lake elevation controlled by dam at Elk Rapids. Maximum depth 192 ft, surface area 7,930 acres. Established legal level; summer, 589.50 ft, winter, 588.90 ft, above NGVD.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 3.88 ft, Oct. 6, 1986; minimum, 2.08 ft, Dec. 30, 31, 1981.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 3.43 ft, Oct. 26; minimum, 2.47 ft, Mar. 9-11, 26.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.18	3.22	2.73	2.59	2.62	2.61	2.60	3.13	3.33	3.25	3.18	3.21
2	3.27	3.20	2.72	2.59	2.62	2.60	2.58	3.13	3.29	3.24	3.21	3.22
3	3.28	3.18	2.69	2.60	2.62	2.59	2.57	3.13	3.26	3.24	3.22	3.22
4	3.29	3.15	2.70	2.61	2.60	2.65	2.60	3.13	3.24	3.23	3.23	3.20
5	3.29	3.17	2.69	2.60	2.60	2.64	2.68	3.14	3.23	3.22	3.24	3.19
6	3.27	3.29	2.67	2.60	2.61	2.59	2.73	3.16	3.21	3.21	3.23	3.20
7	3.26	3.29	2.66	2.61	2.60	2.54	2.77	3.17	3.19	3.19	3.22	3.19
8	3.24	3.29	2.65	2.60	2.61	2.50	2.80	3.18	3.20	3.17	3.20	3.18
9	3.23	3.28	2.64	2.59	2.62	2.48	2.83	3.19	3.29	3.15	3.18	3.21
10	3.21	3.27	2.64	2.59	2.60	2.47	2.85	3.19	3.33	3.13	3.17	3.22
11	3.22	3.26	2.65	2.61	2.57	2.48	2.89	3.20	3.31	3.16	3.17	3.20
12	3.24	3.22	2.63	2.61	2.52	2.49	2.96	3.20	3.30	3.17	3.17	3.17
13	3.23	3.18	2.61	2.62	2.52	2.49	3.03	3.21	3.31	3.16	3.16	3.17
14	3.22	3.13	2.61	2.63	2.55	2.52	3.09	3.22	3.28	3.16	3.16	3.19
15	3.22	3.07	2.64	2.63	2.56	2.58	3.12	3.23	3.27	3.17	3.16	3.20
16	3.22	3.02	2.63	2.63	2.57	2.59	3.13	3.23	3.28	3.19	3.17	3.21
17	3.24	2.93	2.63	2.62	2.58	2.61	3.15	3.23	3.30	3.20	3.18	3.21
18	3.29	2.87	2.62	2.62	2.59	2.62	3.16	3.23	3.30	3.20	3.20	3.21
19	3.30	2.81	2.62	2.62	2.61	2.61	3.16	3.25	3.30	3.24	3.21	3.20
20	3.29	2.77	2.62	2.63	2.60	2.58	3.16	3.27	3.29	3.23	3.21	3.19
21	3.30	2.76	2.63	2.61	2.60	2.57	3.17	3.26	3.29	3.21	3.20	3.18
22	3.34	2.75	2.63	2.60	2.60	2.55	3.18	3.22	3.28	3.18	3.22	3.18
23	3.37	2.73	2.60	2.60	2.59	2.53	3.18	3.20	3.30	3.17	3.19	3.19
24	3.40	2.70	2.59	2.62	2.59	2.51	3.18	3.19	3.31	3.16	3.17	3.19
25	3.40	2.67	2.59	2.65	2.59	2.50	3.18	3.25	3.31	3.16	3.18	3.17
26	3.41	2.66	2.60	2.64	2.61	2.50	3.21	3.24	3.31	3.16	3.19	3.17
27	3.40	2.70	2.62	2.61	2.62	2.54	3.21	3.23	3.30	3.17	3.21	3.17
28	3.37	2.71	2.61	2.58	2.62	2.61	3.20	3.21	3.27	3.17	3.23	3.16
29	3.32	2.73	2.61	2.57	---	2.64	3.17	3.21	3.26	3.16	3.22	3.15
30	3.28	2.72	2.60	2.59	---	2.63	3.13	3.22	3.25	3.17	3.22	3.17
31	3.24	---	2.60	2.60	---	2.62	---	3.33	---	3.17	3.21	---
MEAN	3.28	2.99	2.64	2.61	2.59	2.56	2.99	3.21	3.28	3.19	3.20	3.19
MAX	3.41	3.29	2.73	2.65	2.62	2.65	3.21	3.33	3.33	3.25	3.24	3.22
MIN	3.18	2.66	2.59	2.57	2.52	2.47	2.57	3.13	3.19	3.13	3.16	3.15

CAL YR 1988 MEAN 2.97 MAX 3.41 MIN 2.59
WTR YR 1989 MEAN 2.98 MAX 3.41 MIN 2.47

04127800 JORDAN RIVER NEAR EAST JORDAN, MI

LOCATION.--Lat 45°06'09", long 85°05'53", in NW1/4 NW1/4 sec.7, T.31 N., R.6 W., Antrim County, Hydrologic Unit 04060105, on right bank 300 ft downstream from Webster Bridge, 4.2 mi south of East Jordan, and 4.5 mi upstream from mouth.

DRAINAGE AREA.--67.9 mi^2.

PERIOD OF RECORD.--Occasional low-flow measurements, water years 1960-65. October 1966 to current year.

REVISED RECORDS.--WDR MI-83: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 596.43 ft above National Geodetic Vertical Datum of 1929 (Antrim County Road Commission bench mark). Nov. 19, 1959 to Sept. 30, 1966, nonrecording gage at present site and at site 600 ft upstream at same datum.

REMARKS.--Estimated daily discharges: Dec. 12, 13, Jan. 5, Feb. 4-6, 9, 10, 18, 19, 24, 25, and Mar. 2-8. Records good except for estimated daily discharges, which are fair. Some regulation at low flow by fish hatchery upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--23 years, 188 ft^3/s, 37.60 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,360 ft^3/s, July 19, 1975, gage height, 6.51 ft; minimum, 91 ft^3/s, Mar. 8, 1982, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 400 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Oct. 2	0200	400	4.60	Mar. 27	2400	*773	*5.64
Nov. 6	0400	485	4.88	June 9	1900	491	4.90

Minimum discharge, 116 ft^3/s, Feb. 23, gage height, 2.72 ft, result of freezeup.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	220	212	195	179	196	174	220	183	207	165	158	188
2	279	191	190	183	180	170	244	181	186	164	202	169
3	184	181	194	182	178	170	264	180	181	163	177	161
4	217	182	188	178	176	170	293	178	180	162	182	161
5	202	264	186	180	175	170	313	185	174	161	186	160
6	174	413	188	181	174	170	248	185	173	161	165	158
7	168	231	194	179	173	170	225	182	172	160	165	159
8	166	209	187	196	177	175	213	184	174	159	167	160
9	165	199	184	193	177	175	203	180	356	160	165	208
10	171	254	182	188	178	177	199	177	291	160	161	197
11	190	231	182	180	178	186	199	176	192	159	161	167
12	186	198	182	183	175	188	206	177	185	161	166	165
13	182	234	182	180	176	180	204	183	234	159	160	167
14	176	203	182	179	175	184	211	181	213	162	171	167
15	170	191	182	180	174	259	212	185	211	159	190	163
16	172	235	178	178	173	204	201	180	267	158	173	162
17	179	211	178	180	173	193	220	177	247	158	163	162
18	238	193	178	180	173	190	203	175	235	160	160	161
19	186	192	179	181	173	183	195	188	194	187	159	160
20	175	190	228	180	173	182	191	191	185	171	159	160
21	182	190	250	177	173	180	195	200	179	161	162	160
22	194	184	194	177	172	179	188	180	179	159	191	161
23	185	181	199	178	159	178	185	176	179	159	172	168
24	238	181	200	179	165	193	185	175	176	158	162	168
25	241	180	191	177	170	217	186	232	172	157	160	163
26	245	186	185	181	176	247	203	190	171	157	159	162
27	204	277	188	178	174	464	188	177	170	164	167	162
28	235	222	189	178	172	613	184	174	168	160	166	162
29	195	204	182	179	---	448	184	173	167	157	163	162
30	182	202	180	180	---	279	185	198	166	162	161	161
31	179	---	181	187	---	242	---	287	---	161	161	---
TOTAL	6080	6421	5878	5611	4888	6910	6347	5790	5984	5004	5214	4984
MEAN	196	214	190	181	175	223	212	187	199	161	168	166
MAX	279	413	250	196	196	613	313	287	356	187	202	208
MIN	165	180	178	177	159	170	184	173	166	157	158	158
CFSM	2.89	3.15	2.80	2.67	2.58	3.28	3.12	2.75	2.93	2.37	2.47	2.45
IN.	3.33	3.52	3.22	3.07	2.68	3.79	3.48	3.17	3.28	2.74	2.86	2.73

CAL YR 1988 TOTAL 69047 MEAN 189 MAX 588 MIN 152 CFSM 2.78 IN 37.83
WTR YR 1989 TOTAL 69111 MEAN 189 MAX 613 MIN 157 CFSM 2.78 IN 37.86

04127918 PINE RIVER NEAR RUDYARD, MI

LOCATION.--Lat 46°11'09", long 84°35'52", in NW1/4 NE1/4 sec.30, T.44 N., R.2 W., Chippewa County, Hydrologic Unit 04070002, on right bank 15 ft upstream from county highway bridge, 3.2 mi south of Rudyard.

DRAINAGE AREA.--184 mi^2.

PERIOD OF RECORD.--April 1972 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 600 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to Aug. 4, 1972, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 9 to Apr. 6 and Apr. 19-25. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--17 years, 238 ft^3/s, 17.57 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,500 ft^3/s, Mar. 30, 1986, gage height, 18.44 ft; minimum, 51 ft^3/s, July 29, Aug. 14, 1987; minimum gage height, 1.83 ft, July 29, 30, 1982.

EXTREMES OUTSIDE PERIOD OF RECORD.--A discharge of 50.3 ft^3/s was measured Aug. 6, 1963.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,200 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Nov. 6	0300	*4,200	*16.20	Apr. 5	----	2,800	ice jam
Nov. 27	1400	1,530	7.74	Apr. 17	1400	1,520	7.69
Mar. 29	----	1,900	ice jam				

Minimum discharge, 52 ft^3/s, July 22, 23, 24, 25, 26, gage height, 1.99 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	207	408	472	215	150	100	1400	289	232	76	58	98
2	383	429	385	210	150	100	1700	263	209	74	60	93
3	280	343	345	205	140	98	2000	244	187	73	67	83
4	320	308	282	200	135	98	2400	226	165	70	141	76
5	297	2600	294	200	130	98	2500	223	146	69	145	71
6	238	3560	263	195	130	96	1900	241	138	68	141	68
7	201	1810	292	190	130	96	1550	225	133	65	136	63
8	178	1080	259	185	130	96	1210	210	122	64	115	70
9	166	780	250	180	130	96	940	196	136	63	100	83
10	161	718	240	180	130	98	826	184	144	62	89	93
11	249	730	230	180	130	100	741	172	125	63	81	90
12	344	551	220	175	130	100	751	162	112	61	75	81
13	289	725	215	175	130	100	743	157	113	59	71	74
14	250	618	210	170	130	105	867	154	119	59	66	70
15	229	486	205	170	130	105	957	150	143	58	66	68
16	213	673	200	165	125	105	964	146	156	57	69	64
17	304	716	200	165	120	105	1400	141	164	58	68	62
18	560	542	200	160	120	105	1170	133	197	59	64	62
19	417	465	210	160	115	100	888	128	155	59	63	60
20	312	575	240	155	115	100	730	140	165	58	61	59
21	260	488	270	155	115	100	667	205	144	56	60	60
22	272	402	290	150	110	105	580	187	129	53	61	60
23	252	352	310	150	110	105	520	161	119	53	64	63
24	426	318	320	150	110	105	464	143	117	53	63	67
25	603	294	310	150	105	110	455	261	106	53	61	66
26	423	341	275	150	105	170	461	274	98	56	58	64
27	329	1360	265	150	100	400	438	217	93	82	58	71
28	522	1140	245	150	100	1000	390	181	87	90	63	68
29	442	799	235	150	---	1700	342	157	83	73	67	67
30	348	585	230	150	---	1600	312	141	78	63	95	65
31	300	---	220	150	---	1500	---	176	---	60	100	---
TOTAL	9775	24196	8182	5290	3455	8896	30266	5887	4115	1967	2486	2139
MEAN	315	807	264	171	123	287	1009	190	137	63.5	80.2	71.3
MAX	603	3560	472	215	150	1700	2500	289	232	90	145	98
MIN	161	294	200	150	100	96	312	128	78	53	58	59
CFSM	1.71	4.39	1.44	.93	.67	1.56	5.48	1.03	.75	.35	.44	.39
IN.	1.98	4.89	1.65	1.07	.70	1.80	6.12	1.19	.83	.40	.50	.43

CAL YR 1988 TOTAL 101268 MEAN 277 MAX 3560 MIN 52 CFSM 1.51 IN 20.47
WTR YR 1989 TOTAL 106654 MEAN 292 MAX 3560 MIN 53 CFSM 1.59 IN 21.56

452600084472001 CROOKED LAKE NEAR CONWAY, MI

LOCATION.--Lat 45°23'52", long 84°49'22", in NE1/4 SW1/4 sec.29, T.35 N., R.4 W., Emmet County, Hydrologic Unit 04070004, at Minnehaha Creek Inlet on Channel Road, 2.5 mi southeast of Conway.

DRAINAGE AREA.--101 mi².

PERIOD OF RECORD.--June 1942 to July 1945 (summer months only), August 1945 to current year.

GAGE.--Water-stage recorder. Datum of gage is 593.38 ft above National Geodetic Vertical Datum of 1929. Prior to June 13, 1960, nonrecording gage at datum 1.00 ft higher. June 13, 1960 to June 29, 1964, nonrecording gage at same datum.

REMARKS.--Crooked Lake is the upstream end of the navigable inland water route. Major inlets are Minnehaha Creek, Round Lake Outlet, and Pickerel Lake Outlet. The outlet is Crooked River. Lake elevation controlled by dam and boat lock at Alanson. Maximum depth 68 ft, surface area 2,400 acres.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 3.60 ft, Apr. 12, 1948 (present datum); minimum, 0.54 ft, Mar. 30, 1982.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 2.72 ft, June 10; minimum, 0.99 ft, Feb. 27.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.34	2.48	1.93	1.48	1.20	1.06	1.86	2.30	2.44	2.31	2.14	2.35
2	2.47	2.39	1.87	1.47	1.22	1.09	1.86	2.30	2.43	2.29	2.15	2.40
3	2.46	2.30	1.88	1.49	1.32	1.09	1.88	2.30	2.43	2.27	2.15	2.38
4	2.50	2.22	1.85	1.49	1.24	1.09	1.95	2.31	2.42	2.26	2.30	2.37
5	2.51	2.23	1.82	1.48	1.24	1.09	2.06	2.31	2.40	2.25	2.32	2.35
6	2.48	2.37	1.80	1.47	1.20	1.10	2.10	2.32	2.39	2.23	2.31	2.35
7	2.45	2.35	1.79	1.44	1.19	1.10	2.10	2.32	2.37	2.22	2.28	2.34
8	2.44	2.30	1.77	1.46	1.30	1.10	2.09	2.32	2.38	2.21	2.26	2.34
9	2.42	2.25	1.76	1.53	1.37	1.10	2.07	2.33	2.57	2.20	2.26	2.36
10	2.42	2.25	1.74	1.47	1.35	1.12	2.05	2.34	2.69	2.19	2.25	2.40
11	2.42	2.23	1.73	1.47	1.29	1.12	2.02	2.34	2.67	2.20	2.25	2.39
12	2.40	2.20	1.71	1.46	1.18	1.12	2.01	2.34	2.64	2.19	2.25	2.36
13	2.37	2.17	1.70	1.43	1.13	1.15	1.99	2.35	2.63	2.19	2.23	2.35
14	2.36	2.15	1.69	1.40	1.11	1.15	1.98	2.35	2.63	2.17	2.23	2.34
15	2.35	2.13	1.67	1.38	1.09	1.15	1.99	2.35	2.63	2.17	2.28	2.33
16	2.35	2.10	1.66	1.35	1.10	1.15	1.98	2.34	2.64	2.16	2.27	2.32
17	2.38	2.04	1.64	1.35	1.12	1.20	2.03	2.35	2.65	2.16	2.27	2.31
18	2.42	2.06	1.63	1.34	1.08	1.61	2.02	2.35	2.63	2.16	2.26	2.31
19	2.42	2.05	1.61	1.33	1.10	1.59	2.00	2.35	2.60	2.20	2.26	2.30
20	2.42	2.04	1.61	1.32	1.09	1.59	1.99	2.36	2.58	2.19	2.25	2.30
21	2.42	2.01	1.62	1.34	1.05	1.59	1.99	2.36	2.55	2.19	2.26	2.29
22	2.42	1.98	1.60	1.29	1.05	1.59	2.03	2.36	2.52	2.18	2.27	2.29
23	2.42	1.96	1.61	1.27	1.29	1.48	2.07	2.35	2.51	2.18	2.28	2.30
24	2.48	1.94	1.60	1.25	1.29	1.14	2.10	2.35	2.48	2.17	2.27	2.26
25	2.50	1.91	1.60	1.24	1.28	1.16	2.15	2.39	2.46	2.17	2.27	2.24
26	2.50	1.91	1.56	1.26	1.09	1.20	2.21	2.38	2.43	2.17	2.26	2.25
27	2.50	1.93	1.57	1.24	1.00	1.29	2.24	2.36	2.40	2.16	2.26	2.24
28	2.52	1.95	1.56	1.23	1.03	1.55	2.26	2.34	2.38	2.15	2.27	2.21
29	2.54	1.94	1.54	1.21	---	1.79	2.28	2.34	2.35	2.14	2.28	2.22
30	2.52	1.95	1.52	1.21	---	1.87	2.28	2.34	2.32	2.14	2.26	2.22
31	2.48	---	1.50	1.20	---	1.88	---	2.40	---	2.14	2.26	---
MEAN	2.44	2.13	1.68	1.37	1.18	1.30	2.05	2.34	2.51	2.19	2.26	2.32
MAX	2.54	2.48	1.93	1.53	1.37	1.88	2.28	2.40	2.69	2.31	2.32	2.40
MIN	2.34	1.91	1.50	1.20	1.00	1.06	1.86	2.30	2.32	2.14	2.14	2.21

WTR YR 1989 MEAN 1.98 MAX 2.69 MIN 1.00

04128000 STURGEON RIVER NEAR WOLVERINE, MI

LOCATION.--Lat 45°17'56", long 84°36'40", in SE1/4 NE1/4 sec.36, T.34 N., R.3 W., Cheboygan County, Hydrologic Unit 04070004, on left bank 1.8 mi north of Wolverine, 2.8 mi downstream from West Branch, and 9 mi upstream from mouth.

DRAINAGE AREA.--198 mi².

PERIOD OF RECORD.--April 1942 to current year.

REVISED RECORDS.--WSP 1307: 1944(M), 1948(M). WSP 1727: 1951(M). WDR MI-83: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 740 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to June 15, 1942, nonrecording gage at site 1.0 mi upstream, and June 16, 1942, to Sept. 30, 1958, at site 0.7 mi upstream at different datums.

REMARKS.--Estimated daily discharges: Dec. 13, 14, 17, 18, 30, 31, Jan. 2, 3, 5-7, 10-12, 22, 23, Feb. 4-12, 16, 18-22, 24-26, and Mar. 1-10, 20, 21, 23. Records good except for estimated daily discharges, which are poor. Prior to July 1975, intermittent regulation at low flows by ponds 2.4 mi upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--47 years, 221 ft³/s, 15.16 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,290 ft³/s, Sept. 29, 1972, gage height, 3.72 ft; maximum gage height, 4.48 ft, Sept. 14, 1961; minimum discharge, 94 ft³/s, Jan. 19, 1971, result of freezeup; minimum daily, 113 ft³/s, Aug. 6, 1958.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 847 ft³/s, Mar. 28, gage height, 3.10 ft; minimum, 120 ft³/s, Mar. 22, gage height, 1.39 ft, result of freezeup.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	200	254	271	223	246	208	343	239	287	180	157	295
2	379	258	259	215	229	205	364	237	244	177	166	289
3	291	247	267	210	186	200	413	228	241	176	182	208
4	238	231	262	204	190	200	443	226	229	172	195	193
5	252	309	246	215	195	200	565	225	217	168	239	188
6	226	502	243	225	195	205	467	231	207	168	187	183
7	212	394	247	230	200	205	388	226	199	164	175	180
8	201	297	244	233	200	210	347	231	195	161	174	174
9	198	278	240	239	205	210	327	226	314	161	173	203
10	198	330	237	230	205	215	300	220	352	165	167	263
11	205	372	206	225	205	222	289	219	251	159	164	208
12	206	324	220	220	205	222	290	218	225	160	168	190
13	198	333	225	220	208	216	293	237	267	158	218	181
14	195	322	230	221	205	225	305	236	290	160	202	180
15	192	278	233	221	205	332	340	235	293	161	277	178
16	194	338	236	218	204	289	315	235	295	157	231	174
17	224	353	230	216	202	258	338	223	303	155	193	172
18	294	294	230	216	195	233	312	225	264	155	178	176
19	265	277	227	218	195	228	288	219	246	171	172	170
20	226	269	253	217	190	220	278	234	346	184	168	170
21	215	261	309	209	190	215	272	240	274	166	179	172
22	219	254	254	210	185	213	268	221	237	160	190	169
23	222	245	245	215	182	220	263	213	230	158	208	176
24	289	242	247	216	190	231	257	209	221	160	185	172
25	336	241	242	213	195	264	256	251	210	154	175	171
26	339	239	231	213	200	307	275	249	203	152	175	170
27	318	359	235	213	208	429	259	213	200	154	175	165
28	347	353	241	213	213	718	252	205	194	155	177	167
29	306	291	227	213	---	742	241	202	190	149	180	166
30	265	282	225	213	---	532	238	209	186	156	173	164
31	251	---	225	222	---	390	---	295	---	159	171	---
TOTAL	7701	9027	7487	6766	5628	8764	9586	7077	7410	5035	5774	5667
MEAN	248	301	242	218	201	283	320	228	247	162	186	189
MAX	379	502	309	239	246	742	565	295	352	184	277	295
MIN	192	231	206	204	182	200	238	202	186	149	157	164
CFSM	1.25	1.52	1.22	1.10	1.02	1.43	1.62	1.15	1.25	.82	.94	.96
IN.	1.45	1.70	1.41	1.27	1.06	1.65	1.80	1.33	1.39	.95	1.08	1.06

CAL YR 1988 TOTAL 82341 MEAN 225 MAX 726 MIN 146 CFSM 1.14 IN 15.47
WTR YR 1989 TOTAL 85922 MEAN 235 MAX 742 MIN 149 CFSM 1.19 IN 16.14

STREAMS TRIBUTARY TO LAKE HURON

04129000 PIGEON RIVER NEAR VANDERBILT, MI

LOCATION.--Lat 45°10'15", long 84°26'18", in SE1/4 SW1/4 sec.9, T.32 N., R.1 W., Otsego County, Hydrologic Unit 04070004, on right bank at Pigeon River Country State Forest Headquarters, 11.1 mi east of Vanderbilt, and 26 mi upstream from Mullett Lake.

DRAINAGE AREA.--62.6 mi^2.

PERIOD OF RECORD.--September 1950 to current year.

REVISED RECORDS.--WDR MI-83: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 886.24 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 11-14, 17, 30, Jan. 1, 3, 5, 6, 10-13, 16, 17, 22, 23, Feb. 4-7, 9-14, 16, 18-24, and Mar. 1-3, 5-11, 19, 20, 22. Records good except for estimated daily discharges, which are poor. Prior to May 16, 1957, and since Apr. 22, 1958, occasional regulation by Lansing Club Dam 3.5 mi upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--39 years, 78.5 ft^3/s, 17.03 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,500 ft^3/s, May 15, 1957, gage height, 6.80 ft, from floodmark, from rating curve extended above 500 ft^3/s, result of failure of Lansing Club Dam; minimum discharge, 12 ft^3/s, Mar. 22, 1989; minimum gage height, 1.23 ft, Jan. 8, 1957; minimum daily discharge, 24 ft^3/s, Jan. 8, 1957.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 379 ft^3/s, Nov. 7, gage height, 4.83 ft; minimum, 12 ft^3/s, Mar. 22, gage height, 1.53 ft, result of regulation; minimum daily, 44 ft^3/s, July 28.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	86	87	96	73	83	70	129	81	99	55	52	63
2	148	96	77	69	77	69	115	76	77	58	49	63
3	102	88	86	70	66	68	153	79	75	47	49	58
4	88	96	79	72	66	68	173	76	71	59	64	55
5	104	98	83	74	67	68	229	80	65	51	63	48
6	83	239	76	75	68	69	176	85	73	50	54	60
7	71	186	89	77	69	70	128	76	61	53	51	53
8	73	117	84	80	71	71	115	82	58	49	53	53
9	69	108	77	77	70	72	107	73	78	51	52	59
10	72	133	72	77	70	73	94	74	82	51	53	95
11	72	152	72	76	70	74	89	74	63	48	54	67
12	76	112	74	73	69	75	92	68	69	48	49	56
13	73	129	75	68	68	76	101	85	87	48	61	60
14	66	115	77	66	67	74	103	77	122	53	59	60
15	67	93	80	66	66	119	125	81	110	48	102	58
16	69	145	70	66	65	96	99	89	104	52	66	54
17	95	128	68	67	64	89	131	67	105	49	66	57
18	137	96	65	68	65	80	116	72	98	50	51	57
19	98	103	73	71	65	76	101	72	85	62	59	56
20	91	95	81	71	65	73	93	89	77	58	50	51
21	81	96	103	72	64	71	89	79	69	57	58	54
22	89	80	84	69	64	73	94	78	73	51	58	55
23	79	80	79	67	65	75	87	72	61	52	77	58
24	102	79	83	66	67	76	88	67	65	53	61	55
25	128	84	83	74	69	88	89	82	62	52	59	52
26	128	78	78	71	71	110	97	93	60	52	57	58
27	117	131	76	72	74	154	98	73	58	45	55	52
28	113	130	80	70	71	281	87	64	57	44	58	57
29	107	105	76	72	---	337	84	70	56	48	62	55
30	85	91	77	74	---	169	76	68	56	45	55	49
31	85	---	78	74	---	135	---	95	---	47	57	---
TOTAL	2854	3370	2451	2217	1916	3099	3358	2397	2276	1586	1814	1728
MEAN	92.1	112	79.1	71.5	68.4	100	112	77.3	75.9	51.2	58.5	57.6
MAX	148	239	103	80	83	337	229	95	122	62	102	95
MIN	66	73	65	66	64	68	76	64	56	44	49	48
CFSM	1.47	1.79	1.26	1.14	1.09	1.60	1.79	1.24	1.21	.82	.94	.92
IN.	1.70	2.00	1.46	1.32	1.14	1.84	2.00	1.42	1.35	.94	1.08	1.03

CAL YR 1988 TOTAL 29489 MEAN 80.6 MAX 336 MIN 43 CFSM 1.29 IN 17.52
WTR YR 1989 TOTAL 29066 MEAN 79.6 MAX 337 MIN 44 CFSM 1.27 IN 17.27

04130000 MULLETT LAKE NEAR CHEBOYGAN, MI

LOCATION.--Lat 45°34'38", long 84°29'15", in SW1/4 SW1/4 sec.19, T.37 N., R.1 W., Cheboygan County, Hydrologic Unit 04070004, on right bank of Cheboygan River, 300 ft downstream from Mullett Lake, 2.4 mi upstream from Black River, and 4.8 mi south of Cheboygan.

DRAINAGE AREA.--889 mi².

PERIOD OF RECORD.--November 1942 to current year.

GAGE.--Water-stage recorder. Datum of gage is 591.21 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Mullett Lake is part of the navigable inland water route. The major inlet is Indian River. Other inlets are Pigeon, Little Pigeon, and Little Sturgeon Rivers and Negro and Scott Creeks. The outlet is Cheboygan River. Streamflow records were collected for Cheboygan River (station 04130000) from October 1942 to September 1982 and for Indian River (station 04128500) from April 1942 to September 1982. Lake level regulated by hydroelectric dam and spillway in Cheboygan. Maximum depth 147 ft, surface area 17,100 acres.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily gage height, 3.27 ft, May 13, 14, 1960; minimum daily, 0.88 ft, Mar. 19, 1984.

EXTREMES FOR CURRENT YEAR.--Maximum daily gage height, 2.73 ft, June 11; minimum daily, 1.47 ft, Mar. 12-14.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	2.45	2.27	1.80	1.67	1.49	2.15	2.09	2.55	2.40	2.49	2.50
2	---	2.46	2.27	1.80	1.66	1.48	2.18	2.08	2.58	2.43	2.51	2.51
3	---	2.47	2.17	1.80	1.66	1.48	2.20	2.07	2.58	2.45	2.53	2.48
4	---	2.47	2.12	1.82	1.64	1.54	2.28	2.06	2.58	2.42	2.70	2.48
5	2.59	2.49	2.11	1.83	1.63	1.56	2.38	2.07	2.58	2.44	2.67	2.48
6	2.59	2.68	2.11	1.80	1.62	1.54	2.45	2.06	2.59	2.42	2.63	2.45
7	2.58	2.67	2.05	1.78	1.62	1.52	2.48	2.06	2.58	2.41	2.62	2.45
8	2.54	2.67	2.04	1.79	1.62	1.51	2.47	2.09	2.57	2.42	2.59	2.46
9	2.53	2.72	2.02	1.78	1.60	1.50	2.46	2.09	2.70	2.41	2.54	2.44
10	2.53	2.71	1.99	1.78	1.60	1.49	2.44	2.09	2.72	2.41	2.53	2.45
11	2.50	2.70	1.97	1.77	1.60	1.48	2.43	2.10	2.73	2.44	2.53	2.45
12	2.50	2.67	1.99	1.77	1.59	1.47	2.40	2.19	2.72	2.46	2.52	2.44
13	2.51	2.68	1.93	1.77	1.58	1.47	2.38	2.20	2.66	2.45	2.51	2.40
14	2.50	2.61	1.91	1.75	1.58	1.47	2.37	2.26	2.60	2.46	2.53	2.40
15	2.47	2.55	1.91	1.74	1.56	1.54	2.36	2.27	2.59	2.50	2.57	2.38
16	2.49	2.66	1.92	1.74	1.55	1.54	2.35	2.29	2.61	2.51	2.63	2.35
17	2.47	2.58	1.89	1.73	1.54	1.56	2.36	2.29	2.57	2.51	2.62	2.33
18	2.50	2.49	1.88	1.74	1.53	1.58	2.34	2.32	2.53	2.54	2.64	2.32
19	2.50	2.47	1.87	1.76	1.53	1.58	2.32	2.34	2.49	2.53	2.63	2.31
20	2.52	2.43	1.86	1.74	1.51	1.58	2.31	2.38	2.47	2.53	2.61	2.31
21	2.51	2.40	1.87	1.73	1.50	1.58	2.28	2.39	2.44	2.53	2.60	2.31
22	2.48	2.39	1.85	1.72	1.49	1.57	2.26	2.40	2.47	2.55	2.61	2.29
23	2.48	2.36	1.87	1.70	1.48	1.57	2.24	2.39	2.45	2.55	2.56	2.25
24	2.50	2.33	1.86	1.69	1.48	1.56	2.21	2.42	2.44	2.57	2.54	2.27
25	2.52	2.29	1.85	1.68	1.49	1.57	2.22	2.46	2.45	2.55	2.53	2.27
26	2.52	2.29	1.84	1.70	1.49	1.58	2.21	2.46	2.45	2.54	2.51	2.23
27	2.52	2.35	1.86	1.69	1.50	1.63	2.17	2.43	2.43	2.52	2.50	2.25
28	2.55	2.30	1.85	1.68	1.49	1.78	2.15	2.41	2.41	2.47	2.49	2.29
29	2.50	2.31	1.84	1.67	---	1.94	2.13	2.43	2.41	2.48	2.50	2.22
30	2.48	2.30	1.83	1.67	---	2.05	2.10	2.44	2.40	2.46	2.46	2.24
31	2.49	---	1.82	1.66	---	2.12	---	2.53	---	2.47	2.44	---
MEAN	---	2.50	1.96	1.74	1.56	1.59	2.30	2.26	2.55	2.48	2.56	2.37
MAX	---	2.72	2.27	1.83	1.67	2.12	2.48	2.53	2.73	2.57	2.70	2.51
MIN	---	2.29	1.82	1.66	1.48	1.47	2.10	2.06	2.40	2.40	2.44	2.22

04130500 BLACK RIVER NEAR TOWER, MI

LOCATION.--Lat 45°23'33", long 84°20'00", in SE1/4 NE1/4 sec.29, T.35 N., R.1 E., Cheboygan County, Hydrologic Unit 04070005, on right bank 400 ft downstream from Kleber Dam, 1,000 ft upstream from Milligan Creek, 3.0 mi northwest of Tower, and 10.8 mi upstream from Black Lake.

DRAINAGE AREA.--311 mi^2.

PERIOD OF RECORD.--October 1942 to current year. Monthly discharge only for October 1942, published in WSP 1307.

REVISED RECORDS.--WSP 1307: 1942. WDR MI-83: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 658.00 ft, Stanley Engineering Co. datum. Prior to Aug. 1, 1949, at site 1 mi upstream at different datum.

REMARKS.--No estimated daily discharges. Records good. Flow completely regulated by Kleber Dam 400 ft upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--47 years, 272 ft^3/s, 11.88 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,340 ft^3/s, Apr. 17, 1960, gage height, 7.13 ft; minimum, 0.60 ft^3/s, Mar. 11, 1950; minimum daily, 4.0 ft^3/s, Nov. 27, 1949.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,240 ft^3/s, Mar. 30, gage height, 5.31 ft; minimum, 7.2 ft^3/s, Apr. 27, gage height, 1.13 ft; minimum daily, 110 ft^3/s, July 24.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	170	310	363	202	224	180	847	264	290	146	115	153
2	226	280	341	217	242	180	719	265	294	144	113	296
3	306	279	335	229	254	180	641	302	228	141	112	234
4	360	278	280	229	202	176	643	264	231	144	160	212
5	348	277	338	211	169	167	864	264	230	159	147	182
6	318	388	331	200	180	165	825	265	220	153	159	156
7	268	549	280	227	205	177	800	266	200	150	166	143
8	207	511	277	265	236	200	800	256	181	149	133	140
9	207	581	274	264	203	200	618	243	191	141	117	140
10	254	623	247	264	157	197	498	249	244	141	114	149
11	257	628	196	223	162	200	496	252	266	135	120	171
12	200	522	168	214	187	214	422	227	266	130	129	191
13	190	510	160	249	195	214	436	209	245	134	138	169
14	202	562	193	271	205	214	416	247	208	128	154	149
15	243	542	261	242	219	250	390	320	358	119	159	157
16	247	456	256	202	208	269	381	280	386	118	209	156
17	198	531	268	204	184	269	400	199	336	117	208	151
18	218	506	244	228	171	269	443	219	369	115	201	143
19	247	506	228	250	177	269	437	243	290	113	147	137
20	279	413	219	215	186	269	329	244	276	114	121	131
21	401	414	258	200	196	269	341	246	310	114	121	131
22	346	362	273	199	204	269	358	245	292	115	111	129
23	248	283	274	199	198	234	325	287	251	114	147	135
24	272	351	274	241	179	216	319	251	244	110	174	132
25	318	350	274	252	151	292	270	237	230	121	164	123
26	335	285	261	221	173	409	339	226	217	111	146	125
27	335	340	272	227	200	518	273	226	197	113	134	130
28	335	368	244	238	192	1180	369	226	183	113	129	128
29	335	421	271	238	---	1190	309	211	177	113	129	129
30	344	449	271	238	---	1200	306	192	165	114	130	138
31	347	---	242	229	---	1170	---	188	---	114	130	---
TOTAL	8561	12875	8173	7088	5459	11206	14614	7613	7575	3943	4437	4660
MEAN	276	429	264	229	195	361	487	246	253	127	143	155
MAX	401	628	363	271	254	1200	864	320	386	159	209	296
MIN	170	277	160	199	151	165	270	188	165	110	111	123
CFSM	.89	1.38	.85	.74	.63	1.16	1.57	.79	.81	.41	.46	.50
IN.	1.02	1.54	.98	.85	.65	1.34	1.75	.91	.91	.47	.53	.56

CAL YR 1988 TOTAL 96208 MEAN 263 MAX 1240 MIN 108 CFSM .85 IN 11.51
WTR YR 1989 TOTAL 96204 MEAN 264 MAX 1200 MIN 110 CFSM .85 IN 11.51

04132052 CHEBOYGAN POND AT CHEBOYGAN, MI

LOCATION.--Lat 45°38'09", long 84°28'50", in SW1/4 SE1/4 sec.31, T.38 N., R.1 W., Cheboygan County, Hydrologic Unit 04070004, on right bank 660 ft downstream from Lincoln Avenue in Cheboygan, 1.8 mi upstream from mouth of Cheboygan River.

DRAINAGE AREA.--1,500 mi², approximately.

PERIOD OF RECORD.--November 1942 to current year.

GAGE.--Water-stage recorder. Datum of gage is 590.00 ft above National Geodetic Vertical Datum of 1929. Prior to Aug. 30, 1967, nonrecording gage at same datum.

REMARKS.--Cheboygan Pond is formed by an earthfill dam, hydro-electric dam, boat lock and concrete spillway which contains 6 vertical lift gates. Cheboygan Pond is part of the navigable inland water route. The inlet and outlet of Cheboygan Pond is the Cheboygan River. Other inlets are Black River and Tannery Gulley. Streamflow records for Cheboygan River (station 04130000) were collected from October 1942 to September 1982. Pond elevation regulated by hydroelectric dam and spillway.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 3.93 ft, Nov. 9, 1988; minimum, -0.27 ft, Mar. 11, 12, 1984.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 3.93 ft, Nov. 9; minimum, 1.84 ft, sometime during period Mar. 13-17.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.35	2.99	2.19	2.08	2.09	2.01	2.20	2.19	3.27	3.09	3.34	3.13
2	3.33	3.02	2.02	2.09	2.06	2.00	2.28	2.27	3.30	3.16	3.37	3.12
3	3.37	3.02	1.97	2.09	2.05	1.99	2.18	2.28	3.32	3.28	3.43	3.10
4	3.34	3.00	1.94	2.18	2.05	2.00	2.13	2.29	3.33	3.22	3.44	3.13
5	3.34	2.95	2.01	2.29	2.03	2.01	2.26	2.35	3.34	3.19	3.31	3.14
6	3.34	3.36	2.17	2.09	2.05	2.00	2.30	2.46	3.35	3.19	3.40	3.13
7	3.32	3.13	2.13	2.08	2.04	1.98	2.30	2.48	3.38	3.20	3.39	3.12
8	3.26	3.01	2.14	2.10	2.02	1.98	2.14	2.57	3.31	3.22	3.18	3.10
9	3.29	3.22	2.12	2.08	2.01	1.97	2.17	2.67	3.29	3.20	3.22	3.07
10	3.29	3.00	2.10	2.08	2.01	1.97	2.14	2.68	3.30	3.23	3.26	3.07
11	3.29	2.85	2.11	2.08	2.01	1.97	2.14	2.69	3.32	3.38	3.27	3.07
12	3.27	2.73	2.14	2.09	2.02	1.95	2.12	2.82	3.32	3.41	3.27	3.04
13	3.29	2.73	2.11	2.10	2.00	1.95	2.10	2.99	3.21	3.37	3.27	3.04
14	3.27	2.41	2.10	2.08	2.00	1.95	2.09	2.99	2.82	3.39	3.31	3.03
15	3.22	2.33	2.13	2.07	1.98	1.95	2.08	3.06	2.83	3.44	3.34	2.99
16	3.25	2.48	2.11	2.09	1.99	1.96	2.06	3.01	2.80	3.45	3.54	2.99
17	3.22	2.41	2.07	2.08	1.98	2.00	2.09	3.02	2.83	3.43	3.46	3.00
18	3.22	2.39	2.08	2.08	1.98	2.01	2.10	3.04	2.74	3.49	3.47	3.00
19	3.18	2.37	2.10	2.24	2.00	2.02	2.10	3.07	2.73	3.40	3.41	2.99
20	3.21	2.37	2.10	2.07	1.96	2.00	2.09	3.09	2.69	3.35	3.33	3.02
21	3.15	2.36	2.10	2.11	1.96	2.00	2.12	3.10	2.71	3.35	3.34	3.03
22	3.13	2.38	2.08	2.10	1.95	1.99	2.11	3.13	2.82	3.47	3.30	3.02
23	3.13	2.35	2.12	2.07	1.97	1.99	2.15	3.13	2.88	3.44	3.26	3.08
24	3.11	2.34	2.09	2.07	1.96	1.97	2.15	3.16	2.99	3.41	3.25	3.02
25	3.10	2.31	2.09	2.08	2.02	1.97	2.20	3.17	2.93	3.34	3.26	3.06
26	3.06	2.33	2.08	2.07	2.03	2.00	2.26	3.19	3.02	3.33	3.23	3.09
27	3.06	2.38	2.12	2.06	2.03	2.04	2.25	3.14	3.05	3.33	3.22	3.09
28	3.05	2.33	2.08	2.05	2.02	2.12	2.17	3.10	3.05	3.33	3.19	3.11
29	3.02	2.35	2.09	2.05	---	2.18	2.18	3.24	3.10	3.33	3.17	3.09
30	3.02	2.34	2.07	2.08	---	2.21	2.18	3.26	3.10	3.33	3.15	3.14
31	3.00	---	2.07	2.05	---	2.20	---	3.25	---	3.34	3.11	---
MEAN	3.21	2.64	2.09	2.09	2.01	2.01	2.16	2.87	3.07	3.33	3.31	3.07
MAX	3.37	3.36	2.19	2.29	2.09	2.21	2.30	3.26	3.38	3.49	3.54	3.14
MIN	3.00	2.31	1.94	2.05	1.95	1.95	2.06	2.19	2.69	3.09	3.11	2.99

CAL YR 1988	MEAN 2.78	MAX 3.61	MIN 1.94
WTR YR 1989	MEAN 2.66	MAX 3.54	MIN 1.94

04135000 THUNDER BAY RIVER NEAR ALPENA, MI
(National stream quality accounting network station)

LOCATION.--Lat 45°05'39", long 83°29'59", in SW1/4 SE1/4 sec.7, T.31 N., R.8 E., Alpena County, Hydrologic Unit 04070006, on left bank 1,000 ft downstream from Alpena Power Company Fourmile Dam, 2.5 mi upstream from Bagley Street in Alpena, and 6.0 mi upstream from mouth.

DRAINAGE AREA.--1,238 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--April 1901 to December 1908, October 1979 to current year. Occasional discharge measurements, water years 1945-50.

REVISED RECORDS.--WSP 1307: 1901-09. WDR MI-80: Drainage area.

GAGE.--Two water-stage recorders. Elevation of gage on main (north) channel and secondary gage on (south) channel is 615 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Oct. 1-13, Jan. 1 to Mar. 22, Mar. 27 to Apr. 8, May 12 to June 12, and June 16-18. Water-discharge records good except for estimated daily discharges, which are poor. Flow regulated at all stages by hydroelectric plant 1,000 ft upstream.

AVERAGE DISCHARGE.--17 years (water years 1902-08, 1980-89), 906 ft³/s, 9.94 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 12,100 ft³/s, Mar. 28, 1986; minimum daily, 30 ft³/s, June 5, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 9,630 ft³/s, Mar. 29; minimum daily, 52 ft³/s, Oct. 8.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	74	660	1130	475	872	613	3670	803	594	621	345	305
2	110	737	1130	891	952	607	2980	767	620	526	326	400
3	624	550	1140	850	848	458	2290	704	548	510	327	416
4	618	816	1130	803	447	320	2190	682	536	503	291	411
5	611	694	1130	634	341	292	2330	717	507	539	328	403
6	432	1080	1140	745	762	529	2590	628	478	447	353	399
7	451	1090	1140	511	713	555	2890	618	504	493	313	372
8	52	1140	1160	701	783	572	2710	487	556	451	341	332
9	318	1150	1140	763	717	737	2220	660	642	442	336	359
10	736	1270	872	868	717	461	1910	567	697	513	336	374
11	760	1570	495	870	272	285	2680	552	770	437	319	365
12	456	1570	575	1120	310	279	1650	565	865	378	319	405
13	438	1560	827	1100	716	488	1640	578	858	406	323	401
14	393	1560	1010	490	709	417	1540	604	859	354	331	401
15	84	1560	1200	622	724	568	1510	655	900	374	369	439
16	92	1540	1020	1070	710	734	1520	625	852	328	365	333
17	501	1540	537	755	699	872	1520	615	733	313	394	373
18	668	1310	745	833	285	521	1620	603	786	366	392	387
19	401	1140	1110	886	276	474	1600	609	577	380	388	262
20	487	1140	1070	954	406	534	1500	618	755	332	336	268
21	556	1130	1100	680	681	748	1390	637	689	327	357	378
22	227	1120	1090	199	599	763	1230	638	723	369	289	342
23	733	1110	907	674	694	667	1130	680	773	335	344	256
24	882	988	496	894	513	699	1040	699	756	341	387	250
25	874	1060	727	1080	278	776	1110	661	692	356	343	319
26	452	981	987	734	262	1000	975	600	671	350	341	314
27	563	1000	750	824	692	2110	913	551	634	364	342	276
28	769	1060	1050	568	635	7700	944	517	569	317	273	261
29	451	1130	564	441	---	9630	866	496	598	345	382	316
30	397	1130	895	690	---	8010	837	518	458	320	367	264
31	571	---	493	813	---	6030	---	585	---	255	345	---
TOTAL	14781	34386	28760	23558	16613	48449	52995	19239	20200	12392	10602	10381
MEAN	477	1146	928	760	593	1563	1767	621	673	400	342	346
MAX	882	1570	1200	1120	952	9630	3670	803	900	621	394	439
MIN	52	550	493	199	262	279	837	487	458	255	273	250
CFSM	.39	.93	.75	.61	.48	1.26	1.43	.50	.54	.32	.28	.28
IN.	.44	1.03	.86	.71	.50	1.46	1.59	.58	.61	.37	.32	.31

CAL YR 1988 TOTAL 326280 MEAN 891 MAX 6520 MIN 30 CFSM .72 IN 9.80
WTR YR 1989 TOTAL 292356 MEAN 801 MAX 9630 MIN 52 CFSM .65 IN 8.78

04135000 THUNDER BAY RIVER NEAR ALPENA, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--October 1979 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: October 1979 to September 1985.
WATER TEMPERATURE: October 1979 to September 1985.

INSTRUMENTATION.--Water-quality monitor from Oct. 9, 1980 to Sept. 30, 1985.

REMARKS.--Bimonthly cross-sectional samples were collected near the gage. From February 1979 to September 1979, samples were collected 6.9 mi downstream from gage (station 04135020).

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1980-83): Maximum, 511 microsiemens, Jan. 2, 1982; minimum measured, 120 microsiemens, Dec. 19, 1981.
WATER TEMPERATURE (water years 1980-83): Maximum, 31.0°C, July 11, 12, 1981; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DISCHARGE, INST. CUBIC FEET PER SECOND	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	TEMPERATURE WATER (DEG C)	TURBIDITY (NTU)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	COLIFORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
OCT 13...	1015	434	351	8.18	8.5	2.3	11.1	96	K3	K2
DEC 07...	1200	1200	344	8.21	1.5	1.4	13.6	99	K3	K5
MAR 09...	0930	826	421	8.14	0.0	0.7	11.8	81	--	K4
MAY 03...	0900	387	365	8.24	11.0	5.0	10.2	95	K5	K8
JUL 27...	1030	375	327	8.29	26.5	2.9	7.6	97	K15	50
AUG 24...	0945	377	345	8.29	20.5	3.4	8.3	94	K25	49

DATE	HARDNESS TOTAL (MG/L AS CACO3)	HARDNESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	BICARBONATE WATER DIS IT FIELD MG/L AS HCO3	CARBONATE WATER DIS IT FIELD MG/L AS CO3
OCT 13...	190	22	51	16	6.1	6	0.2	0.9	208	0
DEC 07...	190	31	52	15	5.3	6	0.2	1.2	196	0
MAR 09...	210	7	57	16	5.9	6	0.2	1.0	245	0
MAY 03...	200	19	55	14	4.6	5	0.1	0.7	215	0
JUL 27...	180	15	49	15	5.7	6	0.2	0.6	206	0
AUG 24...	180	23	49	15	5.3	6	0.2	0.6	196	0

DATE	ALKALINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, DISSOLVED (TONS PER AC-FT)	SOLIDS, DISSOLVED (TONS PER DAY)	NITROGEN, NITRITE DISSOLVED (MG/L AS N)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)
OCT 13...	171	13	7.0	0.1	8.7	212	0.29	248	<0.01	<0.10
DEC 07...	161	18	6.7	0.1	9.3	217	0.30	703	<0.01	0.11
MAR 09...	201	14	5.6	0.2	10	250	0.34	558	<0.01	0.14
MAY 03...	176	14	6.0	0.1	4.5	222	0.30	232	<0.01	<0.10
JUL 27...	169	10	5.0	0.2	9.7	205	0.28	208	<0.01	<0.10
AUG 24...	161	11	4.8	0.2	9.7	204	0.28	208	<0.01	<0.10

04135000 THUNDER BAY RIVER NEAR ALPENA, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
OCT 13...	0.02	0.03	0.40	0.01	0.01	<0.01	<10	<1	20	<0.5
DEC 07...	0.02	--	0.60	0.01	<0.01	0.01	<10	<1	22	<0.5
MAR 09...	0.04	0.03	0.30	0.01	<0.01	0.01	--	--	--	--
MAY 03...	0.05	0.05	0.70	0.02	0.01	<0.01	20	<1	27	<0.5
JUL 27...	0.02	0.01	<0.20	0.01	<0.01	<0.01	--	--	--	--
AUG 24...	0.03	0.03	0.30	0.02	<0.01	<0.01	<10	<1	21	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
OCT 13...	<1	<1	<3	1	15	<5	5	1	1.1	<10
DEC 07...	2	<1	<3	2	28	<5	4	4	0.2	<10
MAR 09...	--	--	--	--	--	--	--	--	--	--
MAY 03...	<1	<1	<3	1	41	<5	7	14	<0.1	<10
JUL 27...	--	--	--	--	--	--	--	--	--	--
AUG 24...	<1	<1	<3	3	9	<1	<4	3	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
OCT 13...	<1	<1	<1.0	100	<6	35	1	1.2	71
DEC 07...	<1	<1	<1.0	100	<6	41	3	9.7	80
MAR 09...	--	--	--	--	--	--	3	6.7	70
MAY 03...	<1	<1	<1.0	110	<6	<3	12	13	92
JUL 27...	--	--	--	--	--	--	6	6.1	78
AUG 24...	<1	<1	<1.0	99	<6	11	8	8.1	100

04135500 AU SABLE RIVER AT GRAYLING, MI

LOCATION.--Lat 44°39'35", long 84°42'45", in SE1/4 SE1/4 sec. 7, T.26 N., R.3 W., Crawford County, Hydrologic Unit 04070007, on right bank 65 ft upstream from bridge on Interstate Highway 75 (Business Loop) in Grayling, 0.7 mi upstream from East Branch, and 114 mi upstream from mouth.

DRAINAGE AREA.--110 mi².

PERIOD OF RECORD.--October 1942 to current year. Monthly discharge only for some periods, published in WSP 1307. Prior to October 1954, published as Middle Branch Au Sable River at Grayling.

GAGE.--Water-stage recorder and steel-crested dam. Datum of gage is 1,123.49 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 10-14, 17, 18, 29, 30, Jan. 4-6, 20-25, Feb. 3-5, 17-19, 23-25, and Mar. 3-6, 19-21. Records good except for estimated daily discharges, which are poor. Prior to Dec. 31, 1952, diurnal fluctuation caused by powerplant 2.5 mi upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--47 years, 76.1 ft³/s, 9.39 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 274 ft³/s, June 2, 1943, gage height, 3.00 ft; minimum, 28 ft³/s, Apr. 21, 1946, gage height, 0.80 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 204 ft³/s, Mar. 29, gage height, 2.42 ft; minimum, 45 ft³/s, Sept. 30, gage height, 1.09 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	62	89	116	94	89	73	147	89	124	78	56	58
2	69	88	111	91	88	71	136	86	114	72	56	56
3	80	88	106	91	76	70	140	84	98	69	54	56
4	81	87	104	78	74	64	151	81	89	67	66	56
5	77	98	102	76	78	70	172	81	85	65	70	55
6	73	152	101	86	82	72	175	82	81	64	68	52
7	69	174	99	93	81	74	158	82	79	63	66	50
8	66	163	99	95	80	75	143	85	77	61	65	50
9	65	140	98	90	76	75	132	85	82	60	64	55
10	65	139	88	87	78	77	124	83	100	59	63	70
11	66	143	82	88	81	79	119	80	98	60	61	76
12	69	141	76	88	81	82	117	79	89	61	59	70
13	72	136	84	90	82	82	116	80	87	59	59	66
14	70	134	92	86	81	84	118	80	85	58	59	65
15	69	129	95	85	81	97	119	80	87	58	66	64
16	69	134	93	87	78	95	119	82	96	57	64	69
17	73	138	84	87	70	87	117	82	111	57	61	65
18	90	134	86	87	66	74	121	81	112	58	60	61
19	101	125	90	88	70	76	116	80	110	62	58	58
20	102	120	95	82	79	77	109	83	121	67	58	57
21	95	116	105	74	79	76	103	86	105	67	59	56
22	91	114	111	78	79	76	100	85	96	63	59	54
23	89	110	112	84	68	81	97	81	92	60	60	51
24	90	108	108	84	66	81	95	77	89	58	60	51
25	104	105	105	84	70	87	95	83	86	57	59	54
26	121	105	98	86	78	109	95	89	83	56	57	56
27	123	119	97	86	77	129	95	88	80	55	55	54
28	115	131	95	86	74	166	97	81	78	55	56	50
29	107	130	90	89	---	202	95	77	76	55	62	47
30	100	122	86	89	---	193	92	82	74	56	63	46
31	93	---	94	88	---	169	---	107	---	56	61	---
TOTAL	2616	3712	3002	2677	2162	2923	3613	2581	2784	1893	1884	1728
MEAN	84.4	124	96.8	86.4	77.2	94.3	120	83.3	92.8	61.1	60.8	57.6
MAX	123	174	116	95	89	202	175	107	124	78	70	76
MIN	62	87	76	74	66	64	92	77	74	55	54	46
CFSM	.77	1.13	.88	.79	.70	.86	1.09	.76	.84	.56	.55	.52
IN.	.88	1.26	1.02	.91	.73	.99	1.22	.87	.94	.64	.64	.58

CAL YR 1988 TOTAL 31185 MEAN 85.2 MAX 191 MIN 54 CFSM .78 IN 10.55
WTR YR 1989 TOTAL 31575 MEAN 86.5 MAX 202 MIN 46 CFSM .79 IN 10.68

04135700 SOUTH BRANCH AU SABLE RIVER NEAR LUZERNE, MI

LOCATION.--Lat 44°36'53", long 84°27'20", in SE1/4 SE1/4 sec.29, T.26 N., R.1 W., Crawford County, Hydrologic Unit 04070007, on right bank 10 ft upstream from Smith Bridge, 400 ft downstream from bridge on State Highway 72, 4.6 mi upstream from mouth, and 9.1 mi west of Luzerne.

DRAINAGE AREA.--401 mi².

PERIOD OF RECORD.--Occasional low-flow measurements, water years 1951-66. October 1966 to current year (discontinued).

REVISED RECORDS.--WSP 2111: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 1,070 ft above National Geodetic Vertical Datum of 1929, from topographic map. Apr. 19, 1951, to Nov. 14, 1966, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 10-14, 16, 17, 27, 28, Dec. 30 to Jan. 5, Jan. 8-12, 21, 22, Feb. 3-5, 16-19, 23, 24, Feb. 28 to Mar. 3, and Mar. 6-8, 14-18. Records good except for estimated daily discharges, which are poor. Occasional regulation by dams upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--23 years, 224 ft³/s, 7.59 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,120 ft³/s, Mar. 28, 1976, gage height, 7.30 ft; maximum gage height, 7.75 ft, Jan. 28, 1986, backwater from ice; minimum discharge, 78 ft³/s, Feb. 12, 1981, gage height, 3.98 ft, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 878 ft³/s, Mar. 30, gage height, 6.70 ft; minimum, 100 ft³/s, Sept. 5, 6, 7, 8, gage height, 4.20 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	122	228	354	220	225	160	627	289	246	138	112	105
2	144	225	342	220	211	160	563	282	234	140	110	105
3	150	220	331	220	200	160	538	277	210	140	109	104
4	165	217	313	220	190	163	545	272	190	139	158	104
5	178	247	303	220	190	162	593	269	177	137	172	103
6	170	360	301	217	197	160	600	263	169	134	160	101
7	172	391	300	215	192	160	578	255	163	132	135	102
8	174	415	294	215	186	160	539	253	158	129	127	103
9	171	442	278	215	179	164	497	250	224	128	122	107
10	170	475	250	215	187	164	456	244	269	127	118	114
11	173	474	240	215	180	167	428	238	274	124	117	115
12	172	456	235	215	179	172	412	233	252	124	115	111
13	172	448	235	217	180	176	398	232	227	123	113	108
14	172	433	235	216	180	175	393	230	218	122	113	110
15	169	403	237	212	180	175	393	229	213	121	119	109
16	170	403	230	208	170	175	387	227	220	121	124	107
17	203	394	225	208	170	180	389	224	235	117	118	117
18	241	378	227	208	170	180	389	219	230	116	112	127
19	248	364	222	208	170	184	376	218	221	124	109	134
20	244	358	229	208	170	190	366	222	219	128	109	138
21	248	346	250	205	171	189	351	230	219	121	111	139
22	256	332	248	205	170	192	340	225	198	117	111	140
23	250	322	251	202	165	192	329	223	186	116	113	139
24	252	312	251	203	165	194	317	217	178	115	112	136
25	261	302	249	204	166	216	310	223	166	113	109	137
26	258	299	240	208	164	257	307	222	159	115	107	135
27	252	337	240	205	163	345	303	201	154	120	106	135
28	253	357	238	207	160	614	300	174	150	134	105	133
29	248	358	237	207	---	826	292	165	145	130	112	133
30	240	361	235	209	---	854	293	173	140	117	110	132
31	232	---	230	212	---	770	---	213	---	115	107	---
TOTAL	6330	10657	8050	6559	5030	8036	12609	7192	6044	3877	3675	3583
MEAN	204	355	260	212	180	259	420	232	201	125	119	119
MAX	261	475	354	220	225	854	627	289	274	140	172	140
MIN	122	217	222	202	160	160	292	165	140	113	105	101
CFSM	.51	.89	.65	.53	.45	.65	1.05	.58	.50	.31	.30	.30
IN.	.59	.99	.75	.61	.47	.75	1.17	.67	.56	.36	.34	.33

CAL YR 1988 TOTAL 79357 MEAN 217 MAX 681 MIN 110 CFSM .54 IN 7.36
WTR YR 1989 TOTAL 81642 MEAN 224 MAX 854 MIN 101 CFSM .56 IN 7.57

445512084415301 OTSEGO LAKE NEAR GAYLORD, MI

LOCATION.--Lat 44°55'52", long 84°41'33", in SW1/4 SE1/4 sec.5, T.29 N., R.3 W., Otsego County, Hydrologic Unit 04070007, at Otsego Lake State Park, 200 ft northwest of boat ramp, 6.7 mi south of Gaylord.

DRAINAGE AREA.--Not determined.

PERIOD OF RECORD.--August 1942 to current year, except for winter months 1942-43, 1943-44, 1977-78.

GAGE.--Water-stage recorder. Datum of gage is 1,270.03 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Aug. 18, 1958, nonrecording gage at datum 2.0 ft higher.

REMARKS.--Otsego Lake has no natural inlets or outlets. In December 1972 an outlet tube and pump system was installed connecting the lake with the North Branch Au Sable River to lower lake levels. Maximum depth 23 ft, surface area 1,970 acres. Established legal level; maximum, 1,273.5 ft, minimum, 1,272.0 ft, above NGVD.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 5.10 ft, May 6, 7, 1972; minimum, 0.96 ft, Aug. 14, 1959.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 3.68 ft, Apr. 4, 5, 6, 7, 8, 17; minimum, 2.22 ft, Oct. 1.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.27	2.61	3.10	3.26	3.35	3.43	3.65	3.53	3.39	3.26	2.81	2.60
2	2.35	2.61	3.09	3.27	3.35	3.44	3.64	3.52	3.38	3.25	2.79	2.60
3	2.34	2.59	3.12	3.30	3.35	3.46	3.64	3.50	3.38	3.23	2.78	2.59
4	2.36	2.61	3.09	3.31	3.35	3.53	3.67	3.47	3.37	3.22	2.78	2.57
5	2.37	2.69	3.09	3.31	3.34	3.54	3.68	3.47	3.35	3.20	2.78	2.55
6	2.34	2.76	3.09	3.31	3.35	3.54	3.68	3.47	3.34	3.18	2.78	2.55
7	2.33	2.79	3.09	3.31	3.35	3.54	3.67	3.47	3.33	3.17	2.76	2.54
8	2.33	2.81	3.09	3.31	3.36	3.54	3.66	3.46	3.32	3.14	2.74	2.54
9	2.32	2.80	3.11	3.32	3.38	3.54	3.65	3.45	3.35	3.11	2.72	2.54
10	2.34	2.87	3.11	3.33	3.39	3.52	3.64	3.45	3.36	3.09	2.71	2.54
11	2.39	2.87	3.12	3.34	3.40	3.52	3.64	3.43	3.32	3.07	2.71	2.54
12	2.38	2.86	3.11	3.33	3.40	3.51	3.64	3.42	3.32	3.05	2.71	2.52
13	2.35	2.90	3.12	3.34	3.41	3.51	3.64	3.41	3.35	3.03	2.70	2.49
14	2.34	2.91	3.13	3.33	3.41	3.52	3.64	3.41	3.36	3.01	2.70	2.49
15	2.35	2.90	3.13	3.33	3.41	3.55	3.64	3.41	3.37	2.99	2.70	2.48
16	2.34	2.92	3.13	3.33	3.40	3.56	3.63	3.41	3.38	2.97	2.70	2.47
17	2.39	2.97	3.14	3.34	3.40	3.59	3.65	3.40	3.40	2.95	2.70	2.47
18	2.45	2.98	3.14	3.35	3.40	3.61	3.63	3.39	3.41	2.94	2.70	2.47
19	2.44	2.98	3.15	3.35	3.40	3.60	3.62	3.38	3.41	2.99	2.69	2.46
20	2.43	3.00	3.16	3.35	3.40	3.61	3.61	3.41	3.41	2.98	2.67	2.46
21	2.43	3.00	3.17	3.34	3.40	3.61	3.60	3.41	3.40	2.95	2.67	2.46
22	2.45	2.98	3.17	3.34	3.40	3.61	3.59	3.39	3.39	2.93	2.66	2.46
23	2.44	2.97	3.19	3.34	3.40	3.60	3.58	3.37	3.38	2.93	2.66	2.45
24	2.49	2.98	3.19	3.34	3.40	3.60	3.57	3.36	3.38	2.92	2.66	2.45
25	2.52	2.98	3.20	3.33	3.40	3.60	3.58	3.41	3.37	2.90	2.65	2.44
26	2.56	2.99	3.20	3.35	3.41	3.60	3.58	3.40	3.36	2.89	2.65	2.43
27	2.54	3.04	3.24	3.35	3.41	3.61	3.57	3.39	3.34	2.89	2.64	2.42
28	2.58	3.07	3.25	3.35	3.42	3.66	3.55	3.34	3.33	2.87	2.64	2.41
29	2.60	3.06	3.26	3.35	---	3.66	3.54	3.34	3.30	2.84	2.63	2.39
30	2.59	3.10	3.26	3.35	---	3.66	3.53	3.35	3.28	2.83	2.63	2.39
31	2.57	---	3.26	3.35	---	3.65	---	3.38	---	2.82	2.62	---
MEAN	2.42	2.89	3.15	3.33	3.39	3.57	3.62	3.42	3.36	3.02	2.70	2.49
MAX	2.60	3.10	3.26	3.35	3.42	3.66	3.68	3.53	3.41	3.26	2.81	2.60
MIN	2.27	2.59	3.09	3.26	3.34	3.43	3.53	3.34	3.28	2.82	2.62	2.39

WTR YR 1989 MEAN 3.11 MAX 3.68 MIN 2.27

04136500 AU SABLE RIVER AT MIO, MI

LOCATION.--Lat 44°39'36", long 84°07'52", in SE1/4 NE1/4 sec.12, T.26 N., R.2 E., Oscoda County, Hydrologic Unit 04070007, on right bank 150 ft upstream from bridge on State Highway 33 in Mio, 500 ft downstream from Mio hydroelectric plant, 9.5 mi downstream from Big Creek, and 73.0 mi upstream from mouth.

DRAINAGE AREA.--1,100 mi², approximately.

PERIOD OF RECORD.--July 1952 to current year.

GAGE.--Water-stage recorder. Datum of gage is 929.60 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--No estimated daily discharges. Records good. Flow regulated by Mio Dam 500 ft upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--37 years, 997 ft³/s, 12.31 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,380 ft³/s, Sept. 30, 1986, gage height, 6.16 ft; minimum, 7.0 ft³/s, Aug. 4, 1977, gage height, -0.09 ft; minimum daily, 21 ft³/s, Aug. 9, 1977.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,890 ft³/s, Mar. 30, gage height, 5.95 ft; minimum, 520 ft³/s, Aug. 7, gage height, 2.23 ft; minimum daily, 679 ft³/s, July 28.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	716	966	1250	1010	998	817	2140	1120	1190	765	695	721
2	817	949	1270	976	1010	795	1710	1070	1130	787	689	721
3	875	931	1160	1000	920	795	1680	1050	1030	776	688	704
4	875	930	1150	859	854	700	1830	1060	1000	776	802	695
5	911	1010	1140	794	856	761	2170	1020	921	776	1120	694
6	904	1580	1100	1010	930	842	2100	993	863	759	873	694
7	857	1710	1100	1110	983	810	1930	1030	869	748	761	692
8	840	1590	1100	1100	948	842	1780	1040	858	705	771	689
9	832	1550	1080	966	806	1030	1590	1020	957	695	751	717
10	833	1550	980	901	749	1010	1510	981	1090	716	751	840
11	828	1640	848	968	937	901	1490	955	1120	716	745	862
12	828	1620	705	1050	1030	852	1360	955	1040	718	741	786
13	828	1470	748	1070	1030	851	1400	982	979	689	714	730
14	828	1440	1150	973	1010	882	1420	997	958	695	701	742
15	827	1400	1150	957	973	1100	1440	985	974	705	754	761
16	823	1400	989	967	942	1120	1450	973	1010	710	794	738
17	872	1490	902	949	781	1060	1390	965	1130	695	772	723
18	1000	1400	949	960	701	947	1440	948	1180	684	751	741
19	1300	1280	968	963	904	930	1430	951	1090	695	735	745
20	956	1250	1020	959	1000	957	1320	961	1050	759	722	733
21	973	1250	1130	878	962	950	1250	1060	1050	787	719	728
22	1040	1200	1130	916	925	909	1200	1060	1010	743	719	722
23	1000	1170	1020	1030	753	901	1210	983	954	705	722	721
24	998	1150	1010	993	719	930	1200	916	914	716	723	721
25	1050	1150	1050	943	895	963	1130	934	876	727	721	721
26	1080	1140	1040	970	998	1210	1150	997	863	716	708	724
27	1100	1230	1030	989	936	1600	1180	991	843	709	698	721
28	1080	1400	1040	992	832	2750	1150	916	799	679	697	708
29	1040	1360	996	982	---	3240	1140	863	787	697	724	711
30	995	1300	908	970	---	2880	1130	878	771	709	721	716
31	965	---	1030	970	---	2530	---	982	---	696	721	---
TOTAL	28871	39506	32143	30175	25382	36865	44320	30636	29306	22453	23203	21921
MEAN	931	1317	1037	973	907	1189	1477	988	977	724	748	731
MAX	1300	1710	1270	1110	1030	3240	2170	1120	1190	787	1120	862
MIN	716	930	705	794	701	700	1130	863	771	679	688	689
CFSM	.85	1.20	.94	.89	.83	1.08	1.34	.90	.89	.66	.68	.67
IN.	.98	1.34	1.09	1.02	.86	1.25	1.50	1.04	.99	.76	.78	.74

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CAL YR 1988   TOTAL  360109    MEAN 984    MAX  2350    MIN 591    CFSM .90    IN 12.18
WTR YR 1989   TOTAL  364781    MEAN 999    MAX  3240    MIN 679    CFSM .91    IN 12.34
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04137500 AU SABLE RIVER NEAR AU SABLE, MI
(National stream quality accounting network station)

LOCATION.--Lat 44°26'09", long 83°26'28", in NE1/4 NW1/4 sec.35, T.24 N., R.8 E., Iosco County, Hydrologic Unit 04070007, at bridge on Rea Road, 5.5 mi northwest of Au Sable, and 10.4 mi upstream from mouth.

DRAINAGE AREA.--1,540 mi², approximately.

WATER DISCHARGE RECORDS

PERIOD OF RECORD.--August 1987 to current year. Records for July 1939 to September 1940, published in WSP 874, 894, and 1307, have been found to be unreliable and should not be used.

GAGE.--Water-stage recorder. Datum of gage is 583.93 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 17-20, and Feb. 4 to Mar. 8. Water-discharge records good except for estimated daily discharges, which are fair. Flow regulated by Foote Dam 0.6 mi upstream.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,660 ft³/s, Mar. 29, 1989, gage height, 16.02 ft; minimum, 443 ft³/s, Aug. 13, 1987, gage height, 7.52 ft; minimum daily, 460 ft³/s, Aug. 13, 1987.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 5,660 ft³/s, Mar. 29, gage height, 16.02 ft; minimum, 540 ft³/s, Sept. 7, 8, gage height, 7.76; minimum daily, 633 ft³/s, Sept. 28.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	763	1330	2000	1630	1420	1050	3660	1620	1780	1130	1190	1280
2	1030	1440	2480	1230	1420	1050	2560	1580	1770	1090	1240	1270
3	1380	1300	2830	1530	1470	1050	2420	1460	1470	1090	1230	1260
4	1330	1820	2400	1180	900	1200	2810	1550	1400	1180	1410	1260
5	1310	1530	1260	1090	1250	1000	2940	1580	1570	1210	1860	1230
6	1260	2010	957	1360	1300	1200	2360	1400	1220	1170	1510	1110
7	1180	2950	1230	1880	1300	1400	1970	1480	1210	1010	911	657
8	1090	2010	1110	1840	1300	1200	2350	1520	1360	993	1120	636
9	1080	2010	1010	1140	900	1430	1890	1490	1460	1060	1270	1590
10	1200	2440	973	1050	800	1750	2480	1310	1730	988	1250	1250
11	1550	2460	1060	1660	1400	1260	2140	1340	1830	1040	1250	1240
12	1120	2410	971	1370	1600	1060	1900	1400	1660	1030	1220	1240
13	1150	2170	903	1720	1200	1140	1940	1480	1500	965	1200	1240
14	1040	1960	1700	1650	1600	1530	1910	1500	1440	1010	1200	1240
15	1110	1960	1600	1090	1400	1790	2100	1530	1380	1110	1190	1230
16	1050	2000	1640	1320	1200	1790	2060	1380	1500	1020	1190	1220
17	1130	2040	1300	1380	750	1790	2310	1460	1650	985	1180	1190
18	1970	1940	1650	1380	650	1610	1890	1520	1740	1370	1160	1040
19	2160	1790	1100	1410	1100	1280	2060	1490	1600	945	1140	927
20	1460	1850	1700	1460	1600	1800	1990	1540	1490	933	1150	867
21	1420	1850	1770	993	1700	1700	1690	1520	1540	1000	1120	867
22	1820	1650	1390	1150	900	1890	1880	1540	1580	989	1080	1100
23	1310	1650	1480	1720	750	1820	1790	1450	1540	1070	1060	1260
24	1900	1650	1570	1400	900	1420	1600	1180	1380	1190	1170	1270
25	1340	1840	1650	1130	1400	1650	1690	1330	1180	1110	1270	1280
26	1390	1640	1360	1490	1700	1740	1730	1650	1160	1070	1280	1230
27	1610	1850	1610	1550	1250	1840	1640	1430	1190	1080	1290	774
28	1560	1920	1650	1190	1100	3350	1630	1100	1190	835	1270	633
29	1670	1950	1490	1220	---	5430	1490	1120	1110	765	1270	650
30	1430	1910	1100	1400	---	3570	1620	1460	1130	1290	1280	939
31	1340	---	1520	1430	---	3870	---	1740	---	1010	1270	---
TOTAL	42153	57330	46464	43043	34260	55660	62500	45150	43760	32738	38231	32980
MEAN	1360	1911	1499	1388	1224	1795	2083	1456	1459	1056	1233	1099
MAX	2160	2950	2830	1880	1700	5430	3660	1740	1830	1370	1860	1590
MIN	763	1300	903	993	650	1000	1490	1100	1110	765	911	633
CFSM	.88	1.24	.97	.90	.80	1.17	1.35	.95	.95	.69	.80	.71
IN.	1.02	1.38	1.12	1.04	.83	1.34	1.51	1.09	1.06	.79	.92	.80

CAL YR 1988 TOTAL 527648 MEAN 1442 MAX 3440 MIN 571 CFSM .94 IN 12.75
WTR YR 1989 TOTAL 534269 MEAN 1464 MAX 5430 MIN 633 CFSM .95 IN 12.91

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1978 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: April 1978 to September 1981.
WATER TEMPERATURE: April 1978 to September 1981.

REMARKS.--Bimonthly cross-sectional samples were collected at bridge.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1978-79): Maximum daily, 346 microsiemens, Nov. 21, 1978; minimum daily, 229 microsiemens, Apr. 19, 21, 1979.
WATER TEMPERATURE (water years 1979-80): Maximum measured, 28.0°C, Aug. 8, 1979; minimum daily, 0.0°C on many days during winter.
EXTREMES OUTSIDE PERIOD OF DAILY RECORD.--Specific conductance of 354 microsiemens was measured Feb. 3, 1988.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
OCT 12...	1415	1150	--	8.22	13.0	1.7	9.5	92	K1	--
DEC 08...	1100	1130	275	8.08	3.5	1.7	12.4	95	K1	K2
MAR 08...	1330	2100	326	8.17	0.5	0.5	12.9	90	<1	<1
MAY 02...	1145	2300	--	8.13	10.5	0.7	11.4	105	<1	<1
JUL 26...	1330	1020	285	8.29	25.0	0.6	7.8	96	K3	K22
AUG 23...	1245	1120	286	8.22	22.5	0.5	8.0	95	K3	K8

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
OCT 12...	160	21	44	12	4.7	6	0.2	0.6	169	0
DEC 08...	140	20	41	9.8	3.8	5	0.1	0.9	150	0
MAR 08...	160	11	45	11	4.9	6	0.2	0.7	179	0
MAY 02...	120	9	35	7.9	3.3	6	0.1	0.6	135	0
JUL 26...	150	15	43	11	4.5	6	0.2	0.3	168	0
AUG 23...	150	16	43	11	4.7	6	0.2	0.4	167	0

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
OCT 12...	138	11	5.9	0.1	8.6	176	0.24	546	<0.01	0.24
DEC 08...	123	19	5.3	<0.1	8.4	162	0.22	494	<0.01	0.13
MAR 08...	147	12	5.7	0.1	8.6	188	0.26	1070	<0.01	<0.10
MAY 02...	111	10	4.6	0.1	6.0	147	0.20	913	<0.01	<0.10
JUL 26...	138	9.0	4.9	0.1	8.8	174	0.24	479	<0.01	0.14
AUG 23...	137	9.0	4.8	0.1	9.6	168	0.23	508	<0.01	<0.10

04137500 AU SABLE RIVER NEAR AU SABLE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
OCT 12...	0.02	0.01	0.20	0.01	0.01	<0.01	<10	2	22	<0.5
DEC 08...	0.02	0.02	0.40	<0.01	<0.01	<0.01	<10	1	17	<0.5
MAR 08...	0.02	<0.01	0.20	0.01	<0.01	0.01	--	--	--	--
MAY 02...	0.02	0.03	<0.20	0.02	<0.01	<0.01	20	1	22	<0.5
JUL 26...	0.01	<0.01	0.30	0.01	<0.01	<0.01	--	--	--	--
AUG 23...	0.02	0.01	0.20	0.02	<0.01	<0.01	<10	2	20	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
OCT 12...	<1	<1	<3	4	6	<5	5	2	<0.1	<10
DEC 08...	1	<1	<3	3	44	<5	<4	8	<0.1	<10
MAR 08...	--	--	--	--	--	--	--	--	--	--
MAY 02...	<1	<1	<3	3	20	<5	5	2	<0.1	<10
JUL 26...	--	--	--	--	--	--	--	--	--	--
AUG 23...	<1	<1	<3	2	5	<1	<4	1	0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
OCT 12...	<1	<1	<1.0	75	<6	34	12	37	29
DEC 08...	1	<1	<1.0	61	<6	7	2	6.1	67
MAR 08...	--	--	--	--	--	--	1	5.7	45
MAY 02...	<1	<1	<1.0	52	<6	5	4	25	57
JUL 26...	--	--	--	--	--	--	5	14	80
AUG 23...	<1	<1	<1.0	77	<6	16	3	9.1	100

04142000 RIFLE RIVER NEAR STERLING, MI
(National stream quality accounting network station)

LOCATION.--Lat 44°04'21", long 84°01'12", in NE1/4 SW1/4 sec.5, T.19 N., R.4 E., Arenac County, Hydrologic Unit 04080101, on left bank 30 ft downstream from bridge on Old M-70, 2.8 mi north of Sterling, and 20 mi upstream from mouth.

DRAINAGE AREA.--320 mi², approximately.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--November 1905 to December 1908 (gage heights and discharge measurements only), October 1936 to current year. Monthly discharge only for some periods, published in WSP 1307. Published as Rifle River at Michigan Highway 70 near Sterling 1936-61.

REVISED RECORDS.--WSP 1437: 1937(M), 1939-40(M).

GAGE.--Water-stage recorder. Datum of gage is 649.48 ft above National Geodetic Vertical Datum of 1929. November 1905 to December 1908, nonrecording gage at site 400 ft downstream at different datum. Jan. 13, 1937, to Jan. 10, 1939, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 9 to Mar. 27. Water-discharge records good except for estimated daily discharges, which are poor. Occasional regulation by dams upstream from station.

AVERAGE DISCHARGE.--53 years, 313 ft³/s, 13.28 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,340 ft³/s, Mar. 28, 1950, gage height, 13.74 ft, from rating curve extended above 3,800 ft³/s; minimum, 75 ft³/s, Nov. 22, 1964, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,600 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Mar. 28	1800	*4,010	*11.39	No other peak greater than base discharge.			

Minimum discharge, 129 ft³/s, Sept. 30; minimum gage height, 1.29 ft, Aug. 2.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	166	220	433	240	350	190	1010	283	435	200	143	152
2	231	224	390	235	290	190	901	279	368	193	143	171
3	253	218	360	230	270	190	959	273	304	188	146	159
4	216	218	341	225	250	190	1110	264	370	183	211	149
5	210	307	317	225	240	190	1500	264	347	179	349	144
6	209	849	310	225	235	190	1260	275	296	174	203	141
7	187	848	307	225	230	190	955	262	246	170	169	150
8	180	609	294	230	225	190	784	255	214	162	163	153
9	197	493	250	230	220	190	721	260	328	161	158	169
10	218	661	230	235	215	190	637	246	447	162	155	194
11	207	842	220	240	210	195	573	236	342	155	156	165
12	197	624	215	250	210	210	549	240	274	152	152	150
13	193	525	210	240	205	260	554	267	274	154	147	154
14	191	490	210	230	205	350	552	264	307	157	146	160
15	224	415	210	220	205	600	617	253	362	167	160	155
16	259	386	215	215	200	1100	549	259	421	158	173	145
17	254	421	215	220	200	500	527	244	448	156	153	144
18	449	379	220	225	200	430	577	234	435	154	147	141
19	458	348	225	230	200	380	490	239	542	158	143	136
20	334	356	230	230	200	350	436	266	714	162	145	139
21	279	344	240	225	200	340	403	269	524	154	157	139
22	285	322	270	220	195	330	378	249	439	149	158	133
23	274	308	310	230	195	330	352	230	425	146	171	136
24	293	299	300	260	195	335	333	220	367	144	161	131
25	307	288	290	225	195	375	341	252	309	144	152	135
26	288	287	280	260	195	600	336	284	267	145	144	136
27	272	503	270	240	190	1000	329	240	252	146	142	133
28	249	733	260	230	190	3380	321	223	229	160	141	132
29	236	571	255	300	---	3710	309	216	215	144	155	132
30	227	465	250	330	---	2280	293	235	205	145	156	130
31	221	---	245	290	---	1410	---	325	---	148	147	---
TOTAL	7764	13553	8372	7410	6115	20365	18656	7906	10706	4970	5046	4408
MEAN	250	452	270	239	218	657	622	255	357	160	163	147
MAX	458	849	433	330	350	3710	1500	325	714	200	349	194
MIN	166	218	210	215	190	190	293	216	205	144	141	130
CFSM	.78	1.41	.84	.75	.68	2.05	1.94	.80	1.12	.50	.51	.46
IN.	.90	1.58	.97	.86	.71	2.37	2.17	.92	1.24	.58	.59	.51

CAL YR 1988 TOTAL 107606 MEAN 294 MAX 2150 MIN 129 CFSM .92 IN 12.51
WTR YR 1989 TOTAL 115271 MEAN 316 MAX 3710 MIN 130 CFSM .99 IN 13.40

04142000 RIFLE RIVER NEAR STERLING, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1966-72, 1974 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: November 1974 to September 1981.
WATER TEMPERATURE: November 1974 to September 1981.
SUSPENDED-SEDIMENT DISCHARGE: April to September 1966, October 1969 to September 1970, April to September 1972.

INSTRUMENTATION.--Water-quality monitor from Aug. 28, 1975 to Sept. 30, 1981.

REMARKS.--Quarterly cross-sectional samples were collected at or near bridge.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1975-77, 1979-80): Maximum recorded (more than 20 percent missing record), 567 microsiemens, Sept. 6, 1979; minimum, 157 microsiemens, Aug. 31, 1975, but may have been lower during instrument malfunction Sept. 1-10, 1975.
WATER TEMPERATURE (water years 1976-77, 1980): Maximum, 30.5°C, July 20, 1977; minimum, 0.0°C on many days during winter.
SEDIMENT CONCENTRATION (water years 1970, 1972): Maximum daily mean, 304 mg/L, Apr. 13, 1972; minimum daily, 0 mg/L on several days in water year 1972.
SEDIMENT LOAD (water years 1970, 1972): Maximum daily, 1,760 tons, Apr. 13, 1972; minimum daily, 0 ton on several days during 1972.
EXTREMES OUTSIDE PERIOD OF DAILY RECORD.--A suspended-sediment concentration of 647 mg/L was measured Mar. 27, 1967, and a sediment load of 3,270 tons was calculated Mar. 27, 1967.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
OCT 25...	1130	305	470	8.22	6.5	4.7	11.5	97	290	440
JAN 20...	1030	232	455	8.03	1.0	3.2	12.5	90	K43	K27
APR 04...	1100	1110	285	7.95	4.5	17	11.8	95	K110	9100
JUL 20...	1200	152	426	8.39	19.5	2.3	9.0	101	68	94

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
OCT 25...	--	--	--	17	11	--	--	1.7	221	0
JAN 20...	210	41	61	15	13	12	0.4	1.2	211	0
APR 04...	140	27	41	9.9	5.5	8	0.2	2.0	141	0
JUL 20...	210	29	59	16	10	9	0.3	1.5	215	5

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
OCT 25...	181	38	16	0.1	9.6	--	--	--	0.01	0.32
JAN 20...	173	32	19	0.1	9.4	260	0.35	163	<0.01	0.31
APR 04...	116	18	9.5	0.1	5.8	179	0.24	536	<0.01	0.36
JUL 20...	184	26	12	0.2	7.3	254	0.35	104	<0.01	<0.10

04142000 RIFLE RIVER NEAR STERLING, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
OCT 25...	<0.01	<0.01	0.40	0.01	<0.01	<0.01	<10	2	54	<0.5
JAN 20...	0.05	0.03	<0.20	0.01	<0.01	<0.01	<10	1	48	<0.5
APR 04...	0.11	0.09	0.70	0.06	0.02	0.01	30	1	28	<0.5
JUL 20...	0.05	0.04	0.20	0.01	<0.01	<0.01	10	6	54	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
OCT 25...	<1	<1	<3	1	58	<5	9	11	0.2	<10
JAN 20...	<1	<1	<3	<1	21	<5	6	9	<0.1	<10
APR 04...	<1	<1	<3	3	91	<5	<4	18	<0.1	<10
JUL 20...	<1	<1	<3	1	12	<1	6	9	0.9	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
OCT 25...	1	<1	<1.0	250	<6	7	21	17	53
JAN 20...	<1	<1	<1.0	230	<6	<3	10	6.3	--
APR 04...	3	<1	<1.0	130	<6	3	147	441	74
JUL 20...	1	<1	1.0	250	<6	19	8	3.3	75

04143900 SHIAWASSEE RIVER AT LINDEN, MI

LOCATION.--Lat 42°48'56", long 83°48'08", in SW1/4 sec.19, T.5 N., R.6 E., Genesee County, Hydrologic Unit 04080203, on right bank at upstream side of bridge on Hogan Road, 1.0 mi west of Linden.

DRAINAGE AREA.--83.7 mi^2.

PERIOD OF RECORD.--October 1967 to current year.

REVISED RECORDS.--WDR MI-87: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 844.96 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 12, 13, 16-18, Jan. 9, 10, Feb. 8-10, 23, 24, and Mar. 1, 2, 6-8. Records good except for estimated daily discharges, which are fair. Flow regulated by dam at Linden since 1967. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--22 years, 60.7 ft^3/s, 9.85 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 476 ft^3/s, Apr. 22, 1975, gage height, 7.43 ft; minimum, 0.74 ft^3/s, May 22, 23, 1971; minimum gage height, 2.82 ft, Aug. 2, 1971.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 179 ft^3/s, June 28, gage height, 5.76 ft; maximum gage height 5.86 ft, Nov. 17; minimum daily discharge, 24 ft^3/s, Oct.12.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	88	67	85	74	70	35	116	53	87	156	31	43
2	86	67	81	75	67	32	116	45	99	152	31	44
3	84	61	78	75	67	29	122	42	107	146	27	43
4	73	59	74	75	69	31	131	42	116	134	28	40
5	62	66	66	73	69	33	138	31	127	125	32	34
6	52	86	61	69	67	33	135	33	134	121	32	36
7	45	89	59	61	62	33	135	35	137	113	31	37
8	48	92	56	64	57	32	134	33	135	101	27	41
9	52	102	50	58	54	32	134	36	130	88	27	53
10	49	131	47	58	52	42	132	36	124	80	27	59
11	25	146	46	61	50	55	128	29	117	72	26	59
12	24	147	45	70	49	55	125	28	114	59	27	61
13	41	152	42	77	48	56	121	29	110	44	26	64
14	45	157	39	84	46	59	118	30	103	43	26	65
15	25	160	37	87	41	56	114	30	101	42	28	63
16	25	166	35	87	41	41	107	37	98	38	27	66
17	37	172	34	87	41	69	103	38	90	34	27	68
18	49	162	33	86	41	76	97	31	84	32	27	68
19	51	156	36	77	40	80	93	31	83	32	27	70
20	52	152	44	71	40	92	88	32	90	35	27	69
21	56	149	40	59	40	95	86	32	98	37	27	65
22	60	140	38	56	40	98	83	33	104	34	28	58
23	62	132	38	51	40	102	79	43	110	35	28	52
24	69	125	38	52	39	100	75	52	115	40	28	38
25	74	114	41	53	39	99	73	61	115	43	28	32
26	77	106	42	55	39	97	65	67	122	42	29	30
27	78	105	48	54	39	98	62	64	161	38	31	29
28	78	98	60	54	38	102	60	57	173	40	40	29
29	73	91	63	55	---	108	59	53	167	39	46	31
30	69	87	69	59	---	110	59	55	162	35	45	40
31	67	---	73	65	---	114	---	72	---	32	43	---
TOTAL	1776	3537	1598	2082	1385	2094	3088	1290	3513	2062	934	1487
MEAN	57.3	118	51.5	67.2	49.5	67.5	103	41.6	117	66.5	30.1	49.6
MAX	88	172	85	87	70	114	138	72	173	156	46	70
MIN	24	59	33	51	38	29	59	28	83	32	26	29
CFSM	.69	1.41	.62	.80	.59	.81	1.23	.50	1.40	.80	.36	.59
IN.	.79	1.57	.71	.93	.62	.93	1.37	.57	1.56	.92	.42	.66

CAL YR 1988 TOTAL 19965.6 MEAN 54.6 MAX 172 MIN 5.2 CFSM .65 IN 8.87
WTR YR 1989 TOTAL 24846.0 MEAN 68.1 MAX 173 MIN 24 CFSM .81 IN 11.04

04144500 SHIAWASSEE RIVER AT OWOSSO, MI

LOCATION.--Lat 43°00'54", long 84°10'52", in SW1/4 sec.12, T.7 N., R.2 E., Shiawassee County, Hydrologic Unit 04080203, on right bank on grounds of sewage-treatment plant, 1.5 mi north of Owosso.

DRAINAGE AREA.--538 mi^2.

PERIOD OF RECORD.--March 1931 to current year. Monthly discharge only for some periods, published in WSP 1307. Gage-height records for flood seasons collected in this vicinity 1904, 1910-30 are contained in reports of the National Weather Service.

REVISED RECORDS.--WSP 1307: 1949(M). WSP 1337: 1932, 1934, 1936-38, 1944.

GAGE.--Water-stage recorder. Datum of gage is 707.25 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 15, 1933, at site 1.5 mi upstream at datum 5.46 ft higher.

REMARKS.--Estimated daily discharges: Jan. 12-30 and Feb. 7 to Mar. 3. Records good except for estimated daily discharges, which are fair. Flow regulated below about 800 ft^3/s by powerplant at Shiawasseetown prior to February 1953; occasional regulation at low stages since. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--58 years, 339 ft^3/s, 8.56 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,240 ft^3/s, Apr. 6, 1947, gage height, 10.35 ft; minimum, 0.2 ft^3/s, July 27, 1934, gage height, 1.12 ft; minimum daily, 2.0 ft^3/s, July 28, 1934.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,500 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
June 28	0800	*2,150	*6.29	No other peak greater than base discharge.			

Minimum discharge, 110 ft^3/s, Aug. 13, 14, gage height, 2.46 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	190	257	533	515	477	210	801	292	1210	1400	152	188
2	220	245	492	517	493	205	737	283	1070	1220	123	188
3	219	240	458	444	446	200	725	274	1060	1020	135	183
4	239	238	429	388	389	239	923	263	1240	790	154	186
5	227	274	408	333	354	333	1100	253	1320	683	184	177
6	205	484	395	351	331	385	1070	239	1280	605	171	204
7	206	612	375	457	320	380	1080	225	1160	488	149	262
8	203	623	358	995	310	358	981	213	983	422	137	299
9	192	632	350	836	300	355	867	190	806	381	131	441
10	187	998	341	670	300	327	783	178	691	346	125	507
11	182	1280	268	651	290	326	732	189	609	262	121	484
12	170	1090	240	600	290	353	707	197	527	255	116	474
13	146	1100	238	510	280	349	683	217	433	238	111	430
14	152	1090	311	475	270	355	654	208	441	205	117	371
15	144	999	335	450	270	528	619	206	448	202	143	345
16	147	971	305	420	260	532	591	193	446	185	163	330
17	160	1360	268	410	260	522	570	199	456	168	144	324
18	165	1240	265	400	250	520	509	199	478	157	134	320
19	225	1070	272	390	250	543	546	190	515	150	127	320
20	278	1040	266	380	250	641	490	188	767	161	131	308
21	305	1080	260	360	250	687	470	193	854	174	130	285
22	320	971	278	350	240	689	443	198	1360	176	147	267
23	312	787	309	345	240	733	415	202	1680	180	189	250
24	315	727	324	340	240	876	394	186	1610	172	209	237
25	333	678	341	340	230	888	369	236	1620	157	209	227
26	347	626	336	340	225	813	368	255	1570	145	187	206
27	342	636	364	350	220	763	351	296	1670	134	168	187
28	328	631	480	360	215	780	314	324	2090	189	173	182
29	310	596	531	380	---	1150	308	300	1660	197	168	166
30	290	566	498	410	---	989	300	300	1470	198	158	154
31	271	---	496	442	---	865	---	743	---	178	171	---
TOTAL	7330	23141	11124	14209	8250	16894	18900	7629	31524	11238	4677	8502
MEAN	236	771	359	458	295	545	630	246	1051	363	151	283
MAX	347	1360	533	995	493	1150	1100	743	2090	1400	209	507
MIN	144	238	238	333	215	200	300	178	433	134	111	154
CFSM	.44	1.43	.67	.85	.55	1.01	1.17	.46	1.95	.68	.28	.53
IN.	.51	1.60	.77	.98	.57	1.17	1.31	.53	2.18	.78	.32	.59

CAL YR 1988 TOTAL 122272 MEAN 334 MAX 1950 MIN 20 CFSM .62 IN 8.45
WTR YR 1989 TOTAL 163418 MEAN 448 MAX 2090 MIN 111 CFSM .83 IN 11.30

04145000 SHIAWASSEE RIVER NEAR FERGUS, MI

LOCATION.--Lat 43°15'17", long 84°06'20", in sec.22, T.10 N., R.3 E., Saginaw County, Hydrologic Unit 04080203, on right bank at downstream side of county highway bridge, 1.2 mi east of Fergus, 1.8 mi upstream from Bear Creek, and 14 mi upstream from mouth.

DRAINAGE AREA.--637 mi².

PERIOD OF RECORD.--October 1939 to September 1984, October 1988 to September 1989. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1337: 1940(M), 1941-42, 1943(M), 1944, 1945(M), 1946, 1947(M), 1948, 1950. WSP 1627: 1952, 1954(M), 1957.

GAGE.--Water-stage recorder. Datum of gage is 585.80 ft above National Geodetic Vertical Datum of 1929. Prior to Aug. 22, 1968, nonrecording gage at same site and datum. Prior to Oct. 1, 1970 at datum 2.00 ft higher.

REMARKS.--Estimated daily discharges: Oct. 1-28 and Dec. 9 to Apr. 4. Records good except for estimated daily discharges Oct. 1-28 and records for August and September, which are fair, and estimated daily discharges Dec. 9 to Apr. 4, which are poor. Some regulation at low stages by powerplant at Shiawasseetown prior to February 1953; occasional regulation at low stages since. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.-- 46 years, 423 ft³/s, 9.02 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,500 ft³/s, Apr. 6, 1947, including overflow by-passing gage; maximum gage height, 15.44 ft, present datum, Mar. 29, 1960; minimum discharge, 27 ft³/s, Aug. 8, 1966; minimum gage height, 0.95 ft, Sept. 8, 1984.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,170 ft³/s, June 28, gage height, 7.31 ft; maximum gage height, 8.96 ft, Mar. 15, backwater from ice; minimum discharge, 104 ft³/s, Aug. 14, gage height, 1.23 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	220	288	724	570	530	235	960	340	1790	1460	180	188
2	250	277	653	570	540	230	920	325	1480	1360	141	201
3	250	266	609	520	510	225	1000	312	1220	1180	122	183
4	270	264	569	450	450	250	1140	298	1360	982	153	180
5	260	291	537	400	400	340	1400	283	1400	804	191	187
6	230	520	514	450	370	420	1300	270	1370	726	215	172
7	230	779	496	550	350	410	1250	253	1280	598	161	308
8	230	789	455	1100	340	400	1200	236	1140	496	143	342
9	220	798	420	750	340	390	1070	227	988	450	134	496
10	210	1580	370	700	330	380	962	196	885	410	128	622
11	200	1880	300	620	325	370	889	204	728	358	121	586
12	190	1510	270	580	320	380	849	212	617	264	116	560
13	170	1370	270	540	310	400	833	252	530	306	110	534
14	170	1370	350	510	305	450	792	240	475	251	106	467
15	165	1280	360	500	300	640	768	237	557	233	133	412
16	165	1200	330	480	290	660	717	227	714	225	161	395
17	180	1430	300	460	285	660	683	215	575	224	167	390
18	190	1550	300	440	280	660	640	224	568	197	138	378
19	250	1320	300	430	275	700	603	223	698	186	127	375
20	300	1250	300	420	275	800	622	212	1380	185	129	372
21	330	1340	300	410	270	850	557	215	1060	199	142	350
22	360	1290	310	390	265	860	544	222	1480	210	147	323
23	350	1080	340	390	265	920	492	231	1920	207	198	303
24	360	946	360	380	260	1100	475	224	1840	203	223	279
25	370	897	370	380	255	1050	439	253	1700	188	228	259
26	390	833	370	380	250	1000	429	322	1660	172	205	253
27	385	853	400	390	245	980	424	318	1550	149	176	216
28	383	901	500	400	240	1100	383	381	2060	182	161	206
29	359	823	580	420	---	1400	352	368	1830	207	201	195
30	330	769	560	450	---	1200	351	370	1510	222	155	175
31	304	---	560	490	---	1100	---	1280	---	200	153	---
TOTAL	8271	29744	13077	15520	9175	20560	23044	9170	36365	13034	4865	9907
MEAN	267	991	422	501	328	663	768	296	1212	420	157	330
MAX	390	1880	724	1100	540	1400	1400	1280	2060	1460	228	622
MIN	165	264	270	380	240	225	351	196	475	149	106	172
CFSM	.42	1.56	.66	.79	.52	1.04	1.21	.47	1.90	.66	.25	.52
IN.	.48	1.74	.76	.91	.54	1.20	1.35	.54	2.12	.76	.28	.58

WTR YR 1989 TOTAL 192732 MEAN 528 MAX 2060 MIN 106 CFSM .83 IN 11.26

04146000 FARMERS CREEK NEAR LAPEER, MI

LOCATION.--Lat 43°02'41", long 83°20'14", in sec.6, T.7 N., R.10 E., Lapeer County, Hydrologic Unit 04080204, on left bank on grounds of sewage-treatment plant at Michigan Home and Training School, 2.0 mi west of Lapeer.

DRAINAGE AREA.--55.3 mi^2.

PERIOD OF RECORD.--October 1932 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 924: 1940. WSP 1084: 1942(M), 1943. WSP 1337: 1934-38, 1940(M), 1944(M), 1945, 1946(M), 1948-51(M). WSP 1727: 1952 (M). WDR MI-78: Drainage area.

GAGE.--Water-stage recorder. Concrete control since Oct. 12, 1938. Datum of gage is 805.79 ft above National Geodetic Vertical Datum of 1929. Prior to May 25, 1954, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 11-25, Dec. 31 to Jan. 6, Jan. 10, 11, 19-28, Feb. 4-16, and Sept. 15-20. Records good except for estimated daily discharges, which are fair. Prior to 1941, occasional regulation caused by dam upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--57 years, 31.5 ft^3/s, 7.74 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,380 ft^3/s, Sept. 9, 1985, gage height, 20.95 ft, from floodmark; minimum, 0.14 ft^3/s, Sept. 16, 18, 1970; minimum gage height, 14.18 ft, Jan. 1, 1937.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 102 ft^3/s, Nov. 10, gage height, 16.31 ft, no peak discharge above base discharge of 160 ft^3/s; minimum, 2.2 ft^3/s, Aug. 13, 14, gage height, 15.06 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	6.2	42	29	25	33	12	75	8.7	46	60	5.3	7.7
2	9.9	43	27	24	32	11	71	8.6	60	48	4.5	8.8
3	11	37	26	23	30	13	71	9.1	72	40	3.7	9.2
4	13	31	25	21	26	14	74	9.3	72	35	4.8	7.9
5	13	32	24	20	23	18	76	10	63	29	7.2	6.3
6	13	34	23	21	21	19	81	11	52	22	6.9	6.2
7	13	35	22	23	20	17	83	11	42	14	6.1	6.7
8	15	62	21	43	19	19	80	8.8	36	12	5.8	9.6
9	17	81	19	35	18	18	74	5.3	36	11	4.3	26
10	18	91	17	42	17	17	68	4.6	42	9.7	3.4	31
11	18	77	16	49	16	18	62	4.2	38	8.5	3.1	35
12	19	73	15	56	15	19	58	5.1	34	7.2	3.3	33
13	18	71	15	50	15	19	54	8.9	32	6.3	2.6	27
14	17	65	14	42	15	22	50	7.8	31	5.6	2.6	23
15	17	59	14	36	14	37	48	7.0	33	5.1	4.4	19
16	18	57	13	33	14	35	46	6.2	33	4.6	5.2	18
17	18	52	13	29	13	35	44	5.5	29	4.3	5.3	22
18	18	46	13	26	14	36	42	5.2	26	3.9	4.7	18
19	18	43	13	24	14	37	40	7.5	27	3.2	3.6	15
20	19	41	13	22	14	37	38	11	32	4.6	3.4	14
21	19	40	12	21	13	36	37	16	41	9.8	2.9	13
22	20	38	12	20	14	34	34	16	48	15	5.8	12
23	20	37	12	19	12	35	33	15	55	26	7.2	12
24	19	36	12	19	13	38	25	14	61	23	9.2	14
25	20	35	12	19	13	43	15	16	60	19	8.9	15
26	20	34	17	20	13	46	12	18	57	15	7.0	13
27	21	34	25	22	14	51	10	18	55	13	5.5	14
28	20	32	29	23	13	58	9.9	17	61	11	4.8	13
29	19	31	30	25	---	66	9.8	14	71	9.3	5.4	12
30	19	29	28	28	---	71	9.4	16	69	8.0	5.8	11
31	30	---	27	30	---	76	---	31	---	6.2	6.5	---
TOTAL	536.1	1418	588	890	488	1007	1430.1	345.8	1414	489.3	159.2	472.4
MEAN	17.3	47.3	19.0	28.7	17.4	32.5	47.7	11.2	47.1	15.8	5.14	15.7
MAX	30	91	30	56	33	76	83	31	72	60	9.2	35
MIN	6.2	29	12	19	12	11	9.4	4.2	26	3.2	2.6	6.2
CFSM	.31	.86	.34	.52	.32	.59	.86	.20	.85	.29	.09	.28
IN.	.36	.95	.40	.60	.33	.68	.96	.23	.95	.33	.11	.32

CAL YR 1988 TOTAL 9512.20 MEAN 26.0 MAX 125 MIN .45 CFSM .47 IN 6.40
WTR YR 1989 TOTAL 9237.90 MEAN 25.3 MAX 91 MIN 2.6 CFSM .46 IN 6.21

04146063 SOUTH BRANCH FLINT RIVER NEAR COLUMBIAVILLE, MI

LOCATION.--Lat 43°09'34", long 83°21'03", in NE1/4 NE1/4 sec.36, T.9 N., R.9 E., Lapeer County, Hydrologic Unit 04080204, on right bank at upstream side of bridge on Columbiaville Road, 3.0 mi east of Columbiaville, and 3.2 mi upstream from confluence of North and South Branches.

DRAINAGE AREA.--221 mi².

PERIOD OF RECORD.--March 1980 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 765 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 11-26, Dec. 31 to Jan. 24, and Feb. 4 to Mar. 13. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year. Gage-height telemeter at station.

AVERAGE DISCHARGE.--9 years, 187 ft³/s, 11.49 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,090 ft³/s, Sept. 9, 1985, gage height, 9.60 ft; maximum gage height, 9.61 ft, Feb. 26, 1985, backwater from ice; minimum discharge, 12 ft³/s, July 11, 1988, gage height, 1.22 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 474 ft³/s, June 1, gage height, 3.53 ft; maximum gage height, 4.03 ft, Jan. 9, backwater from ice; minimum daily discharge, 39 ft³/s, July 19.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	52	89	133	140	173	68	283	88	450	184	48	50
2	63	100	127	125	167	68	254	86	432	159	43	59
3	74	101	121	115	142	70	257	84	338	138	40	58
4	69	98	117	105	125	90	330	80	317	125	47	50
5	67	110	110	100	115	110	387	78	262	115	65	46
6	65	192	106	105	105	90	351	77	208	104	58	49
7	63	195	106	120	98	85	319	76	177	91	50	52
8	63	193	103	170	92	76	288	74	154	80	49	60
9	58	224	97	300	88	74	252	71	181	71	49	149
10	59	326	89	260	85	76	223	69	245	65	42	194
11	66	429	85	240	83	80	204	67	214	56	45	142
12	71	320	80	210	81	85	194	67	173	50	46	124
13	69	286	77	190	80	95	198	86	163	49	56	117
14	64	278	74	180	78	103	194	95	156	48	45	97
15	63	245	72	170	77	179	189	94	169	45	58	90
16	65	223	68	155	76	193	191	91	245	45	72	82
17	71	229	67	145	74	166	181	85	199	44	68	93
18	84	201	66	130	73	167	177	77	166	42	67	100
19	89	186	64	120	73	157	170	70	160	39	59	89
20	83	172	63	110	72	162	159	72	315	43	59	80
21	80	200	62	105	71	162	153	85	295	74	55	76
22	83	196	61	100	71	146	145	79	391	92	51	67
23	87	182	61	98	71	140	133	75	379	129	78	64
24	93	175	60	96	70	180	126	76	318	129	77	67
25	98	168	60	104	70	234	113	86	273	110	73	62
26	102	156	85	117	69	244	104	96	227	93	65	56
27	102	153	142	136	69	253	98	100	214	77	59	55
28	97	152	270	125	68	277	94	89	260	68	51	59
29	91	147	218	125	---	372	92	79	229	60	51	68
30	86	137	183	151	---	350	90	90	209	56	53	66
31	81	---	165	162	---	313	---	224	---	52	49	---
TOTAL	2358	5863	3192	4509	2516	4865	5949	2666	7519	2533	1728	2421
MEAN	76.1	195	103	145	89.9	157	198	86.0	251	81.7	55.7	80.7
MAX	102	429	270	300	173	372	387	224	450	184	78	194
MIN	52	89	60	96	68	68	90	67	154	39	40	46
CFSM	.34	.88	.47	.66	.41	.71	.90	.39	1.14	.37	.25	.37
IN.	.40	.99	.54	.76	.42	.82	1.00	.45	1.27	.43	.29	.41

CAL YR 1988 TOTAL 46489 MEAN 127 MAX 606 MIN 15 CFSM .58 IN 7.83
WTR YR 1989 TOTAL 46119 MEAN 126 MAX 450 MIN 39 CFSM .57 IN 7.76

04147000 HOLLOWAY RESERVOIR NEAR OTISVILLE, MI

LOCATION.--Lat 43°07'15", long 83°29'45", in NW1/4 sec.11, T.8 N., R.8 E., Genesee County, Hydrologic Unit 04080204, in gatehouse on right side of Holloway Dam on Flint River, 3.5 mi southeast of Otisville.

DRAINAGE AREA.--526 mi².

PERIOD OF RECORD.--March 1954 to current year.

REVISED RECORDS.--WSP 2111: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is National Geodetic Vertical Datum of 1929 (levels by City of Flint).

REMARKS.--Reservoir is formed by an earth-fill dam with concrete spillway completed in 1953. Capacity of reservoir, 1,256,000,000 ft³ at elevation 760.00 ft. The spillway section includes two 90-foot drum gates with minimum crest elevation of 751 ft, maximum at 755 ft, three 20-foot radial gates with sill elevation of 745 ft, and 2 sluices (each 4 by 6 ft), one on each side with valve controls. Entrance elevation of sluiceways is 724 ft. Reservoir is used to regulate flow for sewage dilution for City of Flint.

COOPERATION.--Reservoir elevations furnished by City of Flint.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents, 996,000,000 ft³, Mar. 8, 1956, elevation, 757.4 ft; minimum, reservoir empty at times during October, November, 1954, January, February, 1955, October, 1971.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 835,000,000 ft³, June 23, elevation, 755.72 ft; minimum, 422,000,000 ft³, Nov. 5, elevation, 750.15 ft.

MONTHEND ELEVATION, IN FEET NGVD, AND CONTENTS, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

Date	Elevation (feet)	Contents (millions of cubic feet)	Change in contents (millions of cubic feet)	(equivalent in ft³/s)
Sept. 30	750.65	452	--	--
Oct. 31	750.57	447	-5	-1.9
Nov. 30	751.29	490	+43	+16.6
Dec. 31	751.33	493	+3	+1.1
CAL YR 1988	--	--	+2	+0.6
Jan. 31	751.35	494	+1	+0.4
Feb. 28	751.06	477	-17	-7.0
Mar. 31	752.07	542	+65	+24.3
Apr. 30	753.85	675	+133	+51.3
May 31	754.80	752	+77	+28.7
June 30	755.32	799	+47	+18.1
July 31	754.89	760	-39	-14.6
Aug. 31	754.87	758	-2	-0.7
Sept. 30	754.90	761	+3	+1.2
WTR YR 1989	--	--	+309	+9.8

04147500 FLINT RIVER NEAR OTISVILLE, MI

LOCATION.--Lat 43°06'40", long 83°31'10", in SE1/4 sec.9, T.8 N., R.8 E., Genesee County, Hydrologic Unit 04080204, on left bank 20 ft downstream from bridge on State Highway 15, 1.5 mi downstream from Holloway Reservoir, 3.5 mi upstream from Powers-Cullen Drain, and 3.8 mi south of Otisville.

DRAINAGE AREA.--530 mi^2.

PERIOD OF RECORD.--October 1952 to current year (discontinued).

REVISED RECORDS.--WDR MI-78: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 721.39 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--No estimated daily discharges. Records good. Flow regulated by Holloway Reservoir, 1.5 mi upstream from station (see preceding page). Several measurements of water temperature were made during the year. City of Flint gage-height telemeter at station.

AVERAGE DISCHARGE.--37 years, 323 ft^3/s, 8.28 in/yr, adjusted for storage since 1954.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,150 ft^3/s, Apr. 1, 1960, gage height, 14.97 ft; minimum, 2.1 ft^3/s, Oct. 11, 12, 1971, gage height, 1.57 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,270 ft^3/s, June 23, gage height, 8.12 ft; minimum, 77 ft^3/s, Aug. 3,4; minimum gage height, 2.52 ft, Aug. 3, 4, 10, 11.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	112	216	292	287	375	127	994	122	694	434	90	97
2	113	215	265	274	387	124	898	121	830	352	83	99
3	113	214	260	242	343	126	859	121	842	293	80	98
4	112	215	250	204	279	126	898	121	816	253	89	98
5	119	217	240	187	241	132	977	122	776	227	102	90
6	126	218	228	196	240	144	984	122	680	195	103	91
7	125	203	228	193	228	144	962	123	576	175	95	100
8	118	173	215	346	209	140	907	126	493	157	90	103
9	118	175	207	500	188	141	818	132	451	142	86	182
10	113	209	198	498	171	143	725	138	452	131	81	243
11	110	443	190	491	160	148	658	134	467	131	82	260
12	109	627	189	515	153	166	593	135	479	118	87	241
13	109	606	188	511	151	188	550	148	441	111	85	222
14	109	612	188	440	148	213	365	154	419	101	86	204
15	109	601	188	372	149	325	267	166	412	96	90	177
16	110	541	188	326	148	418	307	165	449	95	97	167
17	111	555	187	286	145	491	341	160	488	90	107	169
18	111	551	187	259	140	528	362	156	499	88	109	170
19	111	497	187	244	137	484	245	151	635	90	105	167
20	112	444	157	238	136	446	119	155	977	96	102	158
21	112	421	108	218	140	402	120	157	1050	100	103	150
22	113	412	108	195	138	355	119	166	1210	104	110	143
23	113	392	109	209	134	323	119	161	1250	119	121	127
24	113	370	109	212	128	346	119	142	1130	138	123	119
25	113	347	110	207	128	466	119	173	979	142	112	113
26	115	331	112	213	130	599	119	171	840	138	107	110
27	136	310	138	235	131	706	119	173	726	131	104	106
28	194	315	216	251	129	843	121	169	696	124	102	101
29	274	316	287	259	---	1050	121	155	624	109	99	102
30	272	296	293	288	---	1070	121	179	532	109	97	104
31	238	---	285	327	---	1050	---	361	---	96	93	---
TOTAL	4063	11042	6107	9223	5186	11964	14026	4779	20913	4685	3020	4311
MEAN	131	368	197	298	185	386	468	154	697	151	97.4	144
MAX	274	627	293	515	387	1070	994	361	1250	434	123	260
MIN	109	173	108	187	128	124	119	121	412	88	80	90
MEAN+	129	385	198	298	178	410	519	183	715	137	97	145
CFSM+	.24	.73	.37	.56	.34	.77	.98	.35	1.35	.26	.18	.27
IN.+	.28	.81	.43	.65	.35	.89	1.09	.40	1.50	.30	.21	.30

CAL YR 1988 TOTAL 101310 MEAN 277 MAX 1520 MIN 56 MEAN+ 277 CFSM+ .52 IN+ 7.10
WTR YR 1989 TOTAL 99319 MEAN 272 MAX 1250 MIN 80 MEAN+ 282 CFSM+ .53 IN+ 7.22

+ Adjusted for change in contents in Holloway Reservoir.

04148140 KEARSLEY CREEK NEAR DAVISON, MI

LOCATION.--Lat 43°02'01", long 83°34'53", in NE1/4 sec.12, T.7 N., R.7 E., Genesee County, Hydrologic Unit 04080204, on right bank 10 ft upstream from bridge on Davison Road, 1.4 mi downstream from Black Creek, and 3.3 mi west of Davison.

DRAINAGE AREA.--99.4 mi².

PERIOD OF RECORD.--October 1965 to current year.

REVISED RECORDS.--WDR MI-78: Drainage area. WDR MI-85: 1968(M), 1973(M), 1975, 1982(P).

GAGE.--Water-stage recorder. Datum of gage is 747.39 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 10 to Jan. 28 and Feb. 3 to Mar. 13. Records good except for estimated daily discharges, which are fair. Some diurnal fluctuation caused by small dams, and occasional diversion for sprinkler irrigation upstream from station. Several measurements of water temperature were made during the year. Gage-height telemeter at station.

AVERAGE DISCHARGE.--24 years, 72.3 ft³/s, 9.88 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,500 ft³/s, Sept. 9, 1985, gage height, 11.85 ft, from floodmark; minimum, 1.6 ft³/s, July 9, 1988, gage height, 2.62 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 309 ft³/s, June 24, gage height, 6.90 ft, no peak discharge above base discharge of 350 ft³/s; maximum gage height, 7.24 ft, Jan. 8, backwater from ice; minimum discharge, 10 ft³/s, Aug. 11, gage height, 2.96 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	20	28	63	60	85	27	153	39	208	133	21	19
2	26	27	53	56	78	26	132	39	205	103	19	17
3	21	28	49	52	70	30	148	38	201	87	16	17
4	24	31	47	48	62	40	224	37	178	71	21	17
5	26	55	47	45	56	48	224	36	138	55	25	16
6	23	70	47	50	50	38	202	35	125	42	33	14
7	21	72	46	70	48	35	189	34	119	31	30	23
8	19	99	44	180	45	33	170	33	101	30	22	29
9	17	117	40	140	42	32	145	32	79	29	16	105
10	17	211	38	130	40	32	126	32	71	27	13	89
11	19	160	36	115	38	35	114	30	68	24	15	77
12	19	136	35	105	36	40	109	34	74	23	17	60
13	21	143	33	100	35	60	103	42	78	21	13	47
14	20	137	32	92	34	79	95	40	84	20	13	40
15	19	122	31	82	33	150	105	43	84	18	25	35
16	20	152	30	70	32	108	99	44	81	17	21	34
17	26	155	29	65	31	97	94	42	74	16	21	41
18	34	127	29	60	31	101	91	45	66	15	20	38
19	31	116	28	56	30	107	86	53	89	14	17	36
20	39	112	28	54	30	111	78	46	101	24	18	32
21	56	116	27	52	30	99	75	33	134	25	17	28
22	51	102	27	50	29	87	69	28	223	29	31	25
23	31	94	27	49	29	85	65	30	227	77	25	23
24	31	88	26	48	28	116	63	30	273	51	22	21
25	36	82	26	50	28	133	58	44	208	37	21	20
26	39	78	30	52	27	131	51	44	144	28	18	18
27	40	80	70	54	27	135	46	47	264	25	16	17
28	39	74	95	57	27	161	45	44	245	30	13	16
29	36	68	80	60	---	211	40	37	240	24	15	15
30	33	66	72	69	---	183	39	47	198	27	16	14
31	29	---	66	75	---	176	---	137	---	25	15	---
TOTAL	883	2946	1331	2246	1131	2746	3238	1295	4380	1178	605	983
MEAN	28.5	98.2	42.9	72.5	40.4	88.6	108	41.8	146	38.0	19.5	32.8
MAX	56	211	95	180	85	211	224	137	273	133	33	105
MIN	17	27	26	45	27	26	39	28	66	14	13	14
CFSM	.29	.99	.43	.73	.41	.89	1.09	.42	1.47	.38	.20	.33
IN.	.33	1.10	.50	.84	.42	1.03	1.21	.48	1.64	.44	.23	.37

CAL YR 1988 TOTAL 19992.8 MEAN 54.6 MAX 347 MIN 2.1 CFSM .55 IN 7.48
WTR YR 1989 TOTAL 22962.0 MEAN 62.9 MAX 273 MIN 13 CFSM .63 IN 8.59

04148500 FLINT RIVER NEAR FLINT, MI

LOCATION.--Lat 43°02'20", long 83°46'18", in SW1/4 sec.4, T.7 N., R.6 E., Genesee County, Hydrologic Unit 04080204, on left bank on grounds of sewage-treatment plant, 1.2 mi upstream from Pirnie Creek, and 5.0 mi downstream from Swartz Creek.

DRAINAGE AREA.--956 mi².

PERIOD OF RECORD.--September 1903 to March 1904 (gage heights only), August 1932 to current year. Gage height records for flood seasons collected in this vicinity 1911-32, are contained in reports of the National Weather Service.

REVISED RECORDS.--WSP 954: 1941. WSP 1337: 1933-34(M), 1935-37. WDR MI-78: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 678.80 ft above National Geodetic Vertical Datum of 1929 (levels by the National Weather Service and City of Flint).

REMARKS.--No estimated daily discharges. Records good. Some regulation by reservoirs upstream from station (station 04147000). Occasional diversion for industrial use. Since Dec. 17, 1967, flow contains up to 50 ft³/s as sewage effluent which originates outside the basin. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--57 years, 615 ft³/s, 8.74 in/yr, adjusted for storage since 1954.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 14,900 ft³/s, Apr. 6, 1947, gage height, 16.35 ft; maximum gage height, 16.95 ft, Sept. 6, 1985; minimum discharge, 9.0 ft³/s, Aug. 7, 1934.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,500 ft³/s, June 27, gage height, 8.90 ft; minimum daily, 145 ft³/s, Aug. 3.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	204	375	598	516	721	230	1680	309	2100	1140	183	282
2	410	359	486	523	709	223	1520	297	1820	943	164	208
3	250	343	478	492	632	219	1620	265	1740	789	145	174
4	225	365	474	419	544	302	2280	282	1680	629	350	160
5	226	894	530	376	475	418	2290	296	1340	603	437	166
6	218	933	612	391	456	333	1940	273	1180	502	236	187
7	220	669	576	521	434	303	1810	280	1090	421	205	229
8	212	605	485	1600	397	280	1690	251	974	362	186	391
9	205	557	394	1130	365	272	1590	270	1000	314	169	1620
10	222	1710	371	997	338	285	1360	298	1100	302	159	685
11	233	1340	336	936	314	294	1060	274	848	282	353	582
12	203	1230	329	957	291	326	1110	330	845	261	370	489
13	191	1220	308	903	289	346	1140	412	828	245	170	455
14	184	1150	303	788	307	426	1020	326	794	217	198	427
15	183	1110	297	701	292	967	738	330	901	199	363	360
16	214	1580	286	607	283	827	742	329	922	178	308	354
17	329	1580	275	536	277	896	797	321	922	175	215	384
18	401	1240	271	502	262	1070	778	316	875	162	201	335
19	282	1060	278	488	249	1030	739	328	1670	173	181	323
20	247	1060	289	471	258	1010	482	357	2190	288	250	305
21	270	1040	231	417	279	905	460	331	1860	262	212	284
22	322	936	201	394	270	800	422	325	2190	208	543	265
23	298	855	308	396	249	755	381	317	2160	221	378	230
24	321	764	236	411	234	900	379	291	1990	261	267	203
25	340	718	216	407	230	1180	370	639	1750	272	227	205
26	287	700	197	477	239	1240	362	462	1420	290	202	199
27	278	739	521	475	243	1300	344	379	2880	366	184	184
28	279	703	805	472	239	1660	336	351	2220	381	173	177
29	403	654	678	510	---	2220	324	334	1720	288	218	169
30	407	619	621	591	---	1960	300	684	1420	203	204	162
31	400	---	577	645	---	1810	---	1840	---	198	176	---
TOTAL	8464	27108	12567	19049	9876	24787	30064	12097	44429	11135	7627	10194
MEAN	273	904	405	614	353	800	1002	390	1481	359	246	340
MAX	410	1710	805	1600	721	2220	2290	1840	2880	1140	543	1620
MIN	183	343	197	376	230	219	300	251	794	162	145	160
MEAN+	271	920	406	615	346	824	1053	419	1499	345	245	341
CFSM+	.28	.96	.42	.64	.36	.86	1.10	.44	1.57	.36	.26	.36
IN.+	.33	1.07	.49	.74	.38	.99	1.23	.51	1.75	.42	.30	.40

CAL YR 1988 TOTAL 202738 MEAN 554 MAX 3190 MIN 95 MEAN+ 554 CFSM+ .58 IN+ 7.89
WTR YR 1989 TOTAL 217397 MEAN 596 MAX 2880 MIN 145 MEAN+ 605 CFSM+ .63 IN+ 8.60

+ Adjusted for change in contents in Holloway Reservoir.

04149000 FLINT RIVER NEAR FOSTERS, MI

LOCATION.--Lat 43°18'30", long 83°57'13", in SE1/4 SE1/4 sec.35, T.11 N., R.4 E., Saginaw County, Hydrologic Unit 04080204, on left bank 20 ft downstream from bridge on State Highway 13, 2 mi west of Fosters, and 6.5 mi downstream from Silver Creek. Records include flow of Birch Run.

DRAINAGE AREA.--1,188 mi^2, includes that of Birch Run upstream from State Highway 13.

PERIOD OF RECORD.--October 1939 to September 1984, October 1987 to current year. Monthly discharge only for some periods, published in WSP 1307. Gage-height records for flood seasons collected in this vicinity 1910-20, 1922-27 are contained in reports of the National Weather Service.

REVISED RECORDS.--WSP 954: 1941. WSP 1337: 1940, 1942, 1943-44(M), 1945, 1946-47(M), 1948-50. WDR MI-78: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 600 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to Oct. 1, 1969, nonrecording gage at site 2.2 mi upstream at datum 582.22 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 11 to May 14, May 23 to July 14, and Aug. 1-6. Records good except for estimated daily discharges, which are poor. Some regulation by reservoirs upstream from the city of Flint.

AVERAGE DISCHARGE.--47 years, 744 ft^3/s, 8.50 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 19,000 ft^3/s, Apr. 7, 1947, including flow by-passing gage; maximum gage height, 18.6 ft, Feb. 2, 1968, site and datum then in use; minimum discharge observed, 27 ft^3/s, Aug. 6, 1941.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of March 1904 reached a stage of 18.4 ft, from National Weather Service data, site and datum then in use.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,300 ft^3/s, June 1, gage height, 11.04 ft; minimum daily, 190 ft^3/s, Aug. 4.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	253	489	791	750	850	310	2400	400	2500	1850	250	239
2	290	485	740	700	940	300	2200	400	2700	1500	230	355
3	491	461	627	670	920	290	2000	380	2400	1200	210	268
4	328	444	589	620	820	290	2140	350	2300	1000	190	222
5	292	486	600	540	720	400	3000	370	2200	900	450	205
6	283	718	664	500	620	530	2900	380	1800	800	560	213
7	270	1210	730	500	600	440	2600	360	1550	650	287	280
8	269	878	708	750	570	400	2400	370	1400	550	269	314
9	269	789	606	2000	520	370	2200	330	1300	470	238	1180
10	269	1400	533	1500	480	360	2100	360	1350	430	219	1330
11	285	2250	470	1300	440	370	1700	390	1450	390	202	744
12	316	1590	440	1250	410	380	1400	360	1150	370	459	640
13	276	1480	420	1250	380	430	1450	450	1100	350	321	544
14	249	1420	400	1150	380	460	1500	500	1100	320	211	523
15	248	1330	390	1000	400	550	1300	441	1050	298	266	482
16	248	1290	380	900	380	1250	1000	438	1200	275	409	422
17	295	2080	370	800	370	1100	980	421	1200	251	354	449
18	476	1700	350	700	360	1150	1000	415	1150	238	259	445
19	504	1350	360	660	340	1350	1000	416	1150	231	240	396
20	394	1210	360	640	330	1300	900	431	2100	251	228	373
21	349	1300	370	620	350	1300	650	472	2800	391	303	353
22	367	1240	300	550	360	1250	600	436	2500	345	284	330
23	422	1120	270	520	350	1050	550	430	2900	313	690	315
24	420	1020	400	520	330	1000	500	410	2800	319	450	280
25	460	927	310	520	310	1150	500	400	2600	329	331	251
26	460	880	280	540	300	1500	490	820	2200	339	286	248
27	415	895	260	600	310	1650	480	600	1900	353	256	247
28	388	949	700	620	310	1700	450	500	2200	503	234	231
29	381	903	1000	620	---	2200	430	470	2100	445	245	227
30	478	832	990	670	---	2900	420	450	2250	349	279	209
31	489	---	800	750	---	2600	---	1000	---	271	261	---
TOTAL	10934	33126	16208	24710	13450	30330	41240	13950	56400	16281	9472	12315
MEAN	353	1104	523	797	480	978	1375	450	1880	525	306	411
MAX	504	2250	1000	2000	940	2900	3000	1000	2900	1850	690	1330
MIN	248	444	260	500	300	290	420	330	1050	231	190	205

CAL YR 1988 TOTAL 250422 MEAN 684 MAX 3920 MIN 111
WTR YR 1989 TOTAL 278416 MEAN 763 MAX 3000 MIN 190

04150500 CASS RIVER AT CASS CITY, MI

LOCATION.--Lat 43°35'03", long 83°10'34", in NE1/4 NE1/4 sec.4, T.13 N., R.11 E., Tuscola County, Hydrologic Unit 04080205, on left bank 600 ft downstream from bridge on Cemetery Road, 0.3 mi downstream from confluence of North and South Branches, and 1.1 mi south of Cass City.

DRAINAGE AREA.--359 mi².

PERIOD OF RECORD.--October 1947 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1337: 1949-50. WSP 1727: 1948(M), 1950. WDR MI-78: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 697.92 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 14, 1952, nonrecording gage at site 600 ft upstream at present datum.

REMARKS.--Estimated daily discharges: Dec. 9 to Mar. 24. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--42 years, 218 ft³/s, 8.25 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 12,500 ft³/s, Sept. 12, 1986, gage height, 19.82 ft, from floodmark; minimum, 0.50 ft³/s, Sept. 26, 1948.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,400 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Nov. 11	0700	1,680	8.90	Mar. 29	1000	*1,720	8.81
Mar. 15	1600	1,620	*a9.60	Apr 5	0100	1,550	8.52
Mar. 26	0500	1,680	8.76	June 23	2000	1,470	8.61

a Ice jam.

Minimum discharge, 7.7 ft³/s, Aug. 3, gage height, 4.59 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	11	60	185	110	210	39	497	98	386	79	12	29
2	18	63	167	90	180	39	394	90	341	64	9.7	26
3	34	55	156	80	150	39	420	84	242	55	8.5	24
4	49	52	144	72	120	39	958	78	252	48	41	20
5	58	69	133	65	100	40	1300	76	229	42	137	18
6	65	534	128	68	90	41	886	73	190	36	177	15
7	62	472	124	70	80	42	621	66	153	32	158	15
8	52	422	117	400	70	43	469	64	123	27	73	16
9	42	345	105	800	67	44	398	61	131	25	41	25
10	35	784	80	450	64	45	353	57	335	23	30	27
11	34	1570	60	300	60	100	321	52	317	20	25	36
12	38	1130	64	220	58	170	300	57	250	18	25	29
13	34	768	66	170	56	175	300	83	191	16	26	26
14	31	590	67	150	54	180	300	100	150	15	37	24
15	26	434	68	130	52	1250	387	98	131	15	29	21
16	23	366	67	115	50	900	368	86	159	14	41	19
17	23	440	66	100	48	350	330	76	292	13	43	22
18	38	350	64	90	46	180	286	70	271	11	37	26
19	55	278	60	94	44	120	244	66	385	11	31	29
20	56	235	65	98	42	100	209	68	1260	11	27	26
21	53	315	72	88	41	90	181	75	981	13	25	23
22	53	307	80	84	40	85	161	75	600	15	22	20
23	61	276	86	80	40	80	145	69	1030	15	29	19
24	82	237	94	80	40	150	131	61	1090	13	36	17
25	132	203	100	82	39	1420	121	60	588	11	37	15
26	152	182	80	86	39	1490	122	71	349	14	32	13
27	139	231	90	110	39	908	121	81	230	24	26	12
28	118	283	130	130	39	831	114	77	168	21	21	11
29	99	234	170	130	---	1570	110	63	126	18	29	11
30	81	209	160	160	---	1070	105	107	98	16	34	11
31	68	---	140	250	---	698	---	261	---	14	33	---
TOTAL	1822	11494	3188	4953	1958	12328	10652	2503	11048	749	1332.2	625
MEAN	58.8	383	103	160	69.9	398	355	80.7	368	24.2	43.0	20.8
MAX	152	1570	185	800	210	1570	1300	261	1260	79	177	36
MIN	11	52	60	66	39	39	105	52	98	11	8.5	11
CFSM	.16	1.07	.29	.45	.20	1.11	.99	.23	1.03	.07	.12	.06
IN.	.19	1.19	.33	.51	.20	1.28	1.10	.26	1.14	.08	.14	.06

CAL YR 1988 TOTAL 53794.1 MEAN 147 MAX 1930 MIN 2.7 CFSM .41 IN 5.57
WTR YR 1989 TOTAL 62652.2 MEAN 172 MAX 1570 MIN 8.5 CFSM .48 IN 6.49

04150800 CASS RIVER AT WAHJAMEGA, MI

LOCATION.--Lat 43°27'02", long 83°26'29", in NW1/4 NW1/4 sec.20, T.12 N., R.9 E., Tuscola County, Hydrologic Unit 04080205, on right bank 90 ft upstream from bridge on Chambers Road, on grounds of Caro Regional Center at Wahjamega, 1.9 mi downstream from Michigan Sugar Co. dam, and 40 mi upstream from mouth.

DRAINAGE AREA.--645 mi².

PERIOD OF RECORD.--October 1968 to current year.

REVISED RECORDS.--WDR MI-78: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 632.60 ft above National Geodetic Vertical Datum of 1929 (levels by Edmonds Engineering, Inc.). Prior to June 19, 1969, nonrecording gage at bridge 90 ft downstream at present datum.

REMARKS.--Estimated daily discharges: Dec. 10-18, 30, Jan. 3-5, 11-15, 21-23, Feb. 3-11, 17, 18, 23-25, Feb. 27 to Mar. 3, and Mar. 6-9, 19-23. Records good except for estimated daily discharges, which are poor. Some regulation by dam at Michigan Sugar Co., 1.9 mi upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--21 years, 449 ft³/s, 9.45 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 20,000 ft³/s, Sept. 12, 1986, gage height, 26.66 ft, from floodmark; minimum, 16 ft³/s, July 14, 15, 16, 1988, gage height, 2.80 ft.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 2,400 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Mar. 15	2400	*3,470	*11.33	Mar. 29	1900	2,790	10.26
Mar. 26	1300	2,600	9.95	Apr. 5	0800	2,460	9.71

Minimum discharge, 35 ft³/s, Oct. 1; minimum gage height, 2.97 ft, Aug. 4.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	38	132	362	223	516	77	949	216	1320	186	44	73
2	74	124	334	200	394	77	758	200	920	159	41	67
3	61	124	319	160	290	77	737	189	661	140	39	62
4	95	117	297	140	230	79	1270	179	823	128	48	63
5	120	137	278	135	190	80	2280	173	672	117	179	61
6	117	441	265	142	170	81	1570	172	485	105	206	56
7	117	714	258	143	150	82	1130	168	379	95	211	55
8	110	619	243	757	140	84	873	157	329	84	168	54
9	95	544	225	1610	130	86	750	158	333	74	107	71
10	87	939	150	1030	125	91	671	148	605	68	78	89
11	82	1980	120	560	120	160	595	138	791	62	67	80
12	74	1670	125	430	117	332	549	150	570	55	63	78
13	73	1190	130	340	109	320	533	218	457	52	69	71
14	70	955	130	280	106	320	536	247	358	48	91	70
15	68	754	130	250	110	1960	650	245	324	46	112	64
16	70	698	130	227	110	2530	648	222	473	44	91	62
17	77	862	125	200	108	1150	580	197	609	42	84	87
18	107	710	120	184	102	653	519	177	628	40	77	88
19	108	565	117	182	86	440	456	169	541	39	70	89
20	118	494	129	192	83	360	401	171	1480	42	64	83
21	122	546	152	180	87	290	359	190	1530	43	61	72
22	118	590	155	170	88	240	323	181	1040	44	62	68
23	115	520	170	160	90	240	295	164	1060	44	77	60
24	144	465	189	160	85	354	273	147	1770	44	87	54
25	187	412	203	160	80	1670	254	163	1090	42	79	51
26	239	375	165	176	79	2500	253	189	666	39	74	50
27	230	376	191	213	79	1740	255	200	455	41	66	47
28	205	476	285	259	78	1420	248	173	347	51	60	45
29	179	442	387	251	---	2430	237	153	272	49	73	45
30	162	396	330	291	---	2070	225	307	222	49	77	43
31	143	---	278	460	---	1320	---	961	---	47	76	---
TOTAL	3625	18367	6492	9865	4052	23313	19177	6522	21210	2119	2701	1958
MEAN	117	612	209	318	145	752	639	210	707	68.4	87.1	65.3
MAX	239	1980	387	1610	516	2530	2280	961	1770	186	211	89
MIN	38	117	117	135	78	77	225	138	222	39	39	43
CFSM	.18	.95	.32	.49	.23	1.17	.99	.33	1.10	.11	.14	.10
IN.	.21	1.06	.37	.57	.23	1.34	1.11	.38	1.22	.12	.16	.11

CAL YR 1988 TOTAL 112146 MEAN 306 MAX 3780 MIN 17 CFSM .47 IN 6.47
WTR YR 1989 TOTAL 119401 MEAN 327 MAX 2530 MIN 38 CFSM .51 IN 6.89

04151500 CASS RIVER AT FRANKENMUTH, MI

LOCATION.--Lat 43°19'40", long 83°44'53", in NW1/4 SE1/4 sec.27, T.11 N., R.6 E., Saginaw County, Hydrologic Unit 04080205, on right bank 2,000 ft downstream from dam in Frankenmuth, 3,600 ft upstream from highway bridge on Dehmel Road, 3.4 mi upstream from Dead Creek, and 17 mi upstream from mouth.

DRAINAGE AREA.--841 mi².

PERIOD OF RECORD.--February 1908 to March 1909, July 1935 to September 1936, June 1939 to current year.

REVISED RECORDS.--WSP 1307: 1936(M), 1940(M). WSP 1727: 1952. WSP 1911: 1952. WDR MI-78: Drainage area.

GAGE--Water-stage recorder. Datum of gage is 583.96 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). February 1908 to March 1909, nonrecording gage at site 2,000 ft upstream at datum 1.81 ft lower. July 18 to September 11, 1935, nonrecording gage, Sept. 12, 1935, to Sept. 30, 1936, June 20, 1939, to Sept. 30, 1949, water-stage recorder, at site 3,600 ft downstream at datum 0.04 ft higher.

REMARKS.--Estimated daily discharges: Dec. 10-17, Jan. 3-9, 12-21, Feb. 2-19, 22, 23, and Mar. 1-3, 6-8, 18-24. Records good except for estimated daily discharges, which are poor. Occasional regulation by dams upstream from station. Prior to 1950, regulation at low and medium flows by mill upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--51 years, 513 ft³/s, 8.28 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 22,200 ft³/s, Sept. 12, 1986, gage height, 27.52 ft; minimum daily, about 1.5 ft³/s, Aug. 6, 1944.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 3,500 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Mar. 16	1300	*3,570	*13.55	No other peak greater than base discharge.			

Minimum discharge, 56 ft³/s, Aug. 4, gage height, 3.46 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	66	169	471	320	706	115	1490	305	2340	265	66	102
2	89	159	431	279	500	115	1160	286	1710	225	65	99
3	110	153	408	200	400	115	1090	268	1120	193	59	90
4	107	152	387	185	350	116	1520	249	1350	172	76	81
5	123	174	362	180	300	117	2710	237	1180	158	107	80
6	141	305	347	185	250	115	2340	231	796	150	220	84
7	134	772	338	210	230	115	1710	224	593	135	223	87
8	133	738	319	600	210	115	1320	215	482	123	227	92
9	125	662	298	1200	190	119	1100	207	645	110	173	100
10	116	1010	190	1860	180	129	983	204	807	100	122	119
11	113	1880	150	1140	170	193	878	188	1020	94	101	123
12	105	2050	170	650	160	351	801	201	805	86	93	113
13	95	1550	175	500	155	467	782	285	642	80	88	112
14	94	1200	180	430	150	482	773	339	520	78	90	106
15	91	974	175	370	145	1900	884	342	519	76	128	101
16	89	821	170	330	140	3300	925	314	1080	71	139	95
17	96	1090	165	300	135	1820	830	280	1090	69	115	114
18	123	989	166	280	130	800	756	247	1010	69	105	129
19	136	772	160	260	125	600	666	231	932	70	99	126
20	132	666	175	240	126	500	584	233	1650	71	94	118
21	141	682	202	230	123	420	525	255	2100	76	87	109
22	150	747	205	239	120	370	472	251	1620	74	99	99
23	145	687	224	278	120	350	426	232	1200	70	102	88
24	152	615	245	248	118	450	397	210	1730	67	106	79
25	205	547	262	235	118	1630	375	225	1530	68	109	73
26	249	495	227	253	116	2980	368	272	953	68	101	71
27	280	482	241	287	117	2630	365	272	649	66	94	71
28	258	533	361	330	117	2140	358	243	488	66	90	65
29	227	575	422	362	---	2940	340	208	387	70	96	63
30	199	515	473	411	---	3050	321	413	318	72	101	60
31	183	---	417	529	---	2060	---	1490	---	69	99	---
TOTAL	4407	22164	8516	13121	5701	30604	27249	9157	31266	3161	3474	2849
MEAN	142	739	275	423	204	987	908	295	1042	102	112	95.0
MAX	280	2050	473	1860	706	3300	2710	1490	2340	265	227	129
MIN	66	152	150	180	116	115	321	188	318	66	59	60
CFSM	.17	.88	.33	.50	.24	1.17	1.08	.35	1.24	.12	.13	.11
IN.	.19	.98	.38	.58	.25	1.35	1.21	.41	1.38	.14	.15	.13

CAL YR 1988	TOTAL 142927	MEAN 391	MAX 4200	MIN 29	CFSM .47	IN 6.32
WTR YR 1989	TOTAL 161669	MEAN 443	MAX 3300	MIN 59	CFSM .53	IN 7.15

04152238 SOUTH BRANCH TOBACCO RIVER NEAR BEAVERTON, MI

LOCATION.--Lat 43°52'01", long 84°32'43", in SE1/4 NE1/4 sec.16, T.17 N., R.2 W., Gladwin County, Hydrologic Unit 04080201, on left bank 40 ft upstream from bridge on Grout Road, 3.0 mi upstream from Ross Lake, and 3.2 mi southwest of Beaverton.

DRAINAGE AREA.--160 mi^2.

PERIOD OF RECORD.--January 1987 to current year.

GAGE.--Water stage recorder. Datum of gage is 709.92 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 10 to Mar. 27. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,080 ft^3/s, Mar. 29, 1989, gage height, 10.28 ft; maximum gage height, 10.82 ft, Mar. 26, 1989, backwater from ice; minimum discharge, 39 ft^3/s, July 6, Sept. 9, 1988; minimum gage height, 3.26 ft, July 6, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,080 ft^3/s, Mar. 29, gage height, 10.28 ft; maximum gage height, 10.82 ft, Mar. 26, backwater from ice; minimum discharge, 51 ft^3/s, Sept. 29, 30; minimum gage height, 3.55 ft, July 29, Aug. 3, 4.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	57	77	204	90	130	72	338	105	858	90	60	62
2	73	87	177	88	110	72	281	103	744	86	61	64
3	99	92	154	86	100	72	278	103	334	84	59	60
4	80	87	141	84	95	72	332	102	233	79	64	62
5	65	104	128	84	92	72	452	100	193	75	89	57
6	69	291	123	84	88	71	367	100	158	77	79	57
7	64	450	118	84	86	70	281	97	137	75	70	66
8	61	396	115	84	84	70	231	98	116	72	65	69
9	60	286	110	86	82	70	211	96	109	68	62	69
10	63	311	105	88	80	80	185	94	331	68	63	114
11	71	459	100	90	80	100	164	90	241	65	68	90
12	72	344	98	90	79	140	164	89	166	62	74	71
13	70	259	96	88	78	190	183	95	156	62	68	63
14	72	258	94	84	78	230	182	99	159	64	63	66
15	69	197	92	82	77	350	195	96	142	66	65	66
16	67	158	90	80	77	600	183	93	335	64	73	62
17	105	195	88	80	76	350	170	89	308	64	68	59
18	186	161	88	80	76	250	176	87	281	61	63	59
19	204	141	88	86	76	220	160	87	487	62	61	57
20	118	147	88	84	75	200	144	97	898	64	59	55
21	116	150	90	82	75	190	135	101	569	65	60	54
22	111	135	94	80	74	180	120	92	298	66	64	54
23	114	125	110	80	74	180	122	86	217	63	75	54
24	125	119	120	90	74	190	117	85	185	61	72	54
25	168	101	110	82	73	210	115	100	167	59	68	54
26	168	117	105	92	73	300	123	131	136	60	63	55
27	129	236	100	88	73	500	132	107	118	60	63	54
28	107	408	100	84	72	898	120	93	109	60	61	53
29	98	299	100	100	---	1050	111	86	102	55	64	52
30	91	220	100	120	---	871	108	104	95	57	70	52
31	87	---	95	110	---	493	---	435	---	60	65	---
TOTAL	3039	6410	3421	2710	2307	8413	5880	3340	8382	2074	2059	1864
MEAN	98.0	214	110	87.4	82.4	271	196	108	279	66.9	66.4	62.1
MAX	204	459	204	120	130	1050	452	435	898	90	89	114
MIN	57	77	88	80	72	70	108	85	95	55	59	52
CFSM	.61	1.34	.69	.55	.52	1.69	1.23	.68	1.74	.42	.42	.39
IN.	.71	1.49	.80	.63	.54	1.96	1.37	.78	1.95	.48	.48	.43

CAL YR 1988 TOTAL 41608 MEAN 114 MAX 872 MIN 40 CFSM .71 IN 9.67
WTR YR 1989 TOTAL 49899 MEAN 137 MAX 1050 MIN 52 CFSM .86 IN 11.60

04154000 CHIPPEWA RIVER NEAR MOUNT PLEASANT, MI

LOCATION.--Lat 43°37'32", long 84°42'28", in NW1/4 NW1/4 sec.8, T.14 N., R.3 W., Isabella County, Hydrologic Unit 04080202, on right bank 12 ft downstream from bridge on South Leaton Road, 3.8 mi northeast of Mount Pleasant, and 36 mi upstream from mouth.

DRAINAGE AREA.--416 mi^2.

PERIOD OF RECORD.--October 1930 to September 1931, October 1932 to current year. Monthly discharge only for some periods, published in WSP 1307. Gage-height records for flood seasons collected in this vicinity 1910-27, are contained in reports of National Weather Service.

REVISED RECORDS.--WSP 744: Drainage area. WSP 1337: 1931, 1933-40, 1945, 1948-49.

GAGE.--Water-stage recorder. Datum of gage is 710.38 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Oct. 21, 1938, nonrecording gage at site 30 ft upstream at present datum.

REMARKS.--Estimated daily discharges: Dec. 10-20, Dec. 26 to Jan. 17, Jan. 21, 22, Feb. 3 to Mar. 12, and Mar. 18-21. Records good except for estimated daily discharges, which are poor. Diurnal fluctuation below 750 ft^3/s caused by powerplant at Mount Pleasant prior to 1962, occasional regulation at low flow since. Since July 30, 1968, occasional regulation by control structures on lake outlets. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--58 years, 317 ft^3/s, 10.35 in yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,660 ft^3/s, Sept. 12, 1986, gage height, 15.58 ft, from floodmark; minimum, 12 ft^3/s, Aug. 18, 1945; minimum gage height, 2.70 ft, Oct. 8, 1966; minimum daily discharge, 19 ft^3/s, Aug. 16, 1936.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,000 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Nov. 11	0500	1,130	6.06	Mar. 29	2000	1,920	8.34
Mar. 15	2000	1,820	8.05	June 1	0200	1,050	5.83
Mar. 26	1300	1,530	7.22	June 20	1000	*2,030	*8.65

Minimum discharge, 143 ft^3/s, Sept. 27, 28, 30, gage height, 2.97 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	200	364	593	320	454	260	1500	318	960	377	178	167
2	256	361	551	310	373	260	1230	307	827	348	172	163
3	259	358	518	305	350	260	1060	302	758	324	167	158
4	240	352	481	300	340	260	987	294	688	304	248	154
5	229	388	455	300	330	260	1030	286	583	282	261	157
6	214	662	437	300	320	260	947	281	524	274	232	156
7	205	771	423	300	310	260	883	270	464	261	214	184
8	199	670	405	300	300	260	803	266	410	243	200	181
9	198	633	396	305	295	265	729	260	433	236	191	201
10	204	852	390	310	290	275	656	252	483	228	196	219
11	215	1070	380	320	290	300	602	243	392	214	229	215
12	214	917	375	330	285	350	573	239	346	205	204	207
13	211	908	370	315	285	432	558	247	334	196	201	199
14	208	858	365	300	280	506	550	246	329	199	192	195
15	204	743	360	290	280	1420	555	245	344	199	189	189
16	259	693	360	280	275	1120	531	243	539	193	187	186
17	299	667	360	280	275	699	513	242	555	187	179	187
18	360	598	360	285	275	560	493	237	535	183	171	182
19	384	568	355	307	275	500	476	238	782	186	165	176
20	388	555	350	299	270	450	450	252	1850	197	170	172
21	394	523	337	300	270	430	437	258	1350	183	169	168
22	377	493	326	295	270	424	420	252	1250	179	184	166
23	382	468	409	279	270	418	397	243	1130	179	196	160
24	423	443	416	314	270	425	378	236	953	177	192	154
25	441	424	376	288	265	626	362	286	847	172	188	150
26	442	419	370	324	265	1350	357	278	718	172	183	149
27	417	564	365	306	265	1120	351	264	604	188	178	145
28	404	685	360	292	260	1400	345	244	518	191	175	146
29	391	625	355	377	---	1810	340	234	450	196	176	148
30	376	609	350	429	---	1900	330	325	407	195	175	146
31	368	---	340	381	---	1780	---	814	---	187	167	---
TOTAL	9361	18241	12288	9641	8287	20640	18843	8702	20363	6855	5929	5180
MEAN	302	608	396	311	296	666	628	281	679	221	191	173
MAX	442	1070	593	429	454	1900	1500	814	1850	377	261	219
MIN	198	352	326	279	260	260	330	234	329	172	165	145
CFSM	.73	1.46	.95	.75	.71	1.60	1.51	.68	1.63	.53	.46	.42
IN.	.84	1.63	1.10	.86	.74	1.85	1.68	.78	1.82	.61	.53	.46

CAL YR 1988 TOTAL 126531 MEAN 346 MAX 1390 MIN 99 CFSM .83 IN 11.31
WTR YR 1989 TOTAL 144330 MEAN 395 MAX 1900 MIN 145 CFSM .95 IN 12.91

04155000 PINE RIVER AT ALMA, MI

LOCATION.--Lat 43°22'46", long 84°39'20", in SW1/4 SE1/4 sec.34, T.12 N., R.3 W., Gratiot County, Hydrologic Unit 04080202, on right bank 270 ft downstream from Superior Street Bridge in Alma, 0.6 mi downstream from municipal reservoir, and 38 mi upstream from mouth.

DRAINAGE AREA.--288 mi².

PERIOD OF RECORD.--October 1930 to current year. Gage-height records for flood seasons collected in this vicinity 1910-28 are contained in reports of National Weather Service.

REVISED RECORDS.--WSP 744: Drainage area. WSP 1307: 1945(M). WSP 1337: 1931, 1932-34(M), 1936, 1939, 1945, 1949.

GAGE.--Water-stage recorder. Datum of gage is 718.37 ft above National Geodetic Vertical Datum of 1929. Prior to Dec. 10, 1930, nonrecording gage at Superior Street Bridge at different datum. Dec. 10, 1930, to June 15, 1938, nonrecording gage at site 70 ft downstream from bridge, and June 16 to Oct. 25, 1938, nonrecording gage at bridge at present datum.

REMARKS.--Estimated daily discharges: Dec. 7-21, 29, 30, Jan. 2-4, 7-10, Feb. 6 to Mar. 8, and Mar. 11-14. Records fair except for estimated daily discharges, which are poor. Flow regulated by dam 0.6 mi upstream from station, and by variable backwater from powerplant at St. Louis, 5.2 mi downstream. About 4.1 ft³/s diverted upstream from station for municipal and industrial use; sewage effluent is returned downstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--59 years, 221 ft³/s, 10.42 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,160 ft³/s, Sept. 12, 1986, gage height, 12.82 ft, from floodmark; minimum daily, 0.40 ft³/s, Sept. 6, 1964, caused by closing dam during construction of waterworks.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,370 ft³/s, June 23, gage height, 6.79 ft; minimum, 57 ft³/s, Aug. 19; minimum gage height, 1.11 ft, Sept. 28.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	105	148	347	191	393	125	806	218	1000	327	94	114
2	162	167	314	185	326	125	693	206	1060	257	105	98
3	197	203	305	180	270	125	611	189	1010	220	83	89
4	188	173	289	180	215	125	574	176	914	185	123	97
5	183	175	266	175	193	125	536	179	745	158	155	113
6	159	275	247	178	175	125	493	174	594	150	186	118
7	143	367	230	180	165	125	494	174	453	150	203	224
8	161	404	220	185	155	125	455	173	345	146	156	203
9	155	456	210	195	145	126	417	177	276	131	107	215
10	140	742	200	205	140	131	360	175	270	117	87	173
11	127	749	190	224	135	150	331	165	242	111	100	147
12	124	679	185	245	135	180	325	159	216	115	105	123
13	150	699	180	249	135	220	307	171	197	111	108	114
14	165	654	175	210	135	300	306	190	190	124	122	110
15	123	580	170	191	130	1050	331	195	207	128	122	106
16	147	543	170	198	130	864	320	156	251	116	92	101
17	174	486	170	201	130	1230	305	149	231	98	79	96
18	175	428	170	208	130	1140	304	147	244	86	70	93
19	188	388	170	234	130	972	278	147	485	73	61	95
20	203	379	170	230	130	692	270	155	664	72	74	101
21	211	349	190	207	130	556	248	167	489	73	99	109
22	198	334	220	191	130	462	235	176	761	82	110	107
23	189	316	270	192	130	380	228	173	1270	91	103	99
24	199	298	288	187	130	435	222	161	1170	94	113	88
25	219	280	305	182	125	645	218	207	933	92	122	82
26	233	264	294	236	125	608	217	210	833	90	113	74
27	243	284	238	268	125	699	212	209	711	86	99	69
28	243	304	236	238	125	944	215	184	584	90	84	69
29	213	318	230	246	---	1060	220	167	484	106	80	86
30	185	317	220	304	---	971	226	421	407	116	91	103
31	162	---	210	326	---	931	---	1090	---	87	104	---
TOTAL	5464	11759	7079	6621	4517	15746	10757	6640	17236	3882	3350	3416
MEAN	176	392	228	214	161	508	359	214	575	125	108	114
MAX	243	749	347	326	393	1230	806	1090	1270	327	203	224
MIN	105	148	170	175	125	125	212	147	190	72	61	69
CFSM	.61	1.36	.79	.74	.56	1.76	1.25	.74	2.00	.43	.38	.40
IN.	.71	1.52	.91	.86	.58	2.03	1.39	.86	2.23	.50	.43	.44

CAL YR 1988 TOTAL 79084.8 MEAN 216 MAX 1020 MIN 5.5 CFSM .75 IN 10.22
WTR YR 1989 TOTAL 96467.0 MEAN 264 MAX 1270 MIN 61 CFSM .92 IN 12.46

04155500 PINE RIVER NEAR MIDLAND, MI

LOCATION.--Lat 43°33'52", long 84°22'09", in SW1/4 NW1/4 sec.4, T.13 N., R.1 E., Midland County, Hydrologic Unit 04080202, on left bank at downstream side of bridge on Meridian Road, 7.2 mi southwest of Midland, and 7.8 mi upstream from Chippewa River.

DRAINAGE AREA.--390 mi², approximately.

PERIOD OF RECORD.--May 1934 to September 1938, February 1948 to current year.

REVISED RECORDS.--WSP 1207: Drainage area. WSP 1307: 1935(M). WSP 1337: 1936-38, 1948-49.

GAGE.--Water-stage recorder. Datum of gage is 623.94 ft above National Geodetic Vertical Datum of 1929. Prior to Sept. 30, 1938, nonrecording gage at same site at datum 5.55 ft lower. Feb. 3, 1948, to Dec. 13, 1951, nonrecording gage at present site and datum.

REMARKS.--Estimated daily discharges: Dec. 9 to Mar. 25. Records good except for estimated daily discharges, which are poor. Regulation at low and medium flows by hydroelectric powerplant at St. Louis. Some diversion upstream from station for irrigation. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--45 years, 308 ft³/s, 10.72 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 9,360 ft³/s, Sept. 12, 1986, gage height, 11.74 ft; maximum gage height, 12.08 ft, Feb. 2, 1968, backwater from ice; minimum discharge since 1953, 7.6 ft³/s, July 1, 2, 1988; minimum daily, 7.8 ft³/s, July 2, 1988.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,200 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Nov. 10	2200	1,710	5.51	June 1	0200	*2,750	6.72
Mar. 19	--	2,000	*a7.06	June 20	0600	2,390	6.35
Mar. 26	1000	1,290	4.82	June 24	0800	1,850	5.71
Mar. 29	0700	1,730	5.42				

a Ice jam.

Minimum discharge, 47 ft³/s, Aug. 11, 12, gage height, 2.27 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	89	255	327	310	600	210	1090	245	2280	469	84	90
2	76	118	491	300	660	210	938	242	1580	405	54	144
3	108	68	325	290	450	210	731	237	1390	278	83	126
4	300	226	370	290	370	205	866	226	1420	266	121	102
5	225	293	370	290	320	205	863	182	1120	254	164	69
6	216	330	360	290	300	205	702	181	757	203	203	115
7	210	598	310	300	280	205	570	179	729	154	225	239
8	91	555	304	310	260	205	625	179	464	148	256	469
9	115	561	300	320	250	210	587	161	465	169	244	266
10	175	1090	270	340	240	220	555	170	579	165	185	296
11	169	1360	230	370	230	240	464	180	463	129	87	250
12	166	1040	200	400	225	350	400	179	377	95	74	240
13	90	844	230	410	220	500	475	139	334	116	113	172
14	67	924	250	360	220	640	410	137	280	112	116	160
15	220	764	260	330	220	840	443	160	274	109	118	160
16	111	748	260	320	220	1200	523	252	305	127	165	160
17	66	707	260	330	220	1400	467	163	434	138	136	157
18	186	559	260	350	220	1600	334	143	391	111	112	143
19	207	570	260	370	220	1700	415	146	918	111	111	130
20	207	452	260	390	220	1400	320	151	2040	111	98	115
21	208	508	270	360	220	800	371	150	970	108	55	100
22	232	403	280	330	220	650	315	152	893	97	99	114
23	246	413	300	320	220	550	305	154	1430	83	160	126
24	248	398	320	340	215	750	269	156	1770	85	153	124
25	252	384	340	310	215	900	252	210	1380	84	140	121
26	252	363	350	250	215	1140	258	297	1080	86	133	119
27	251	376	360	200	215	857	252	261	954	89	134	114
28	249	389	360	250	210	1170	251	269	835	88	132	112
29	261	400	360	360	---	1620	252	224	534	73	132	73
30	261	548	350	450	---	1350	247	489	543	63	93	50
31	259	---	330	540	---	1160	---	1910	---	126	84	---
TOTAL	5813	16244	9517	10380	7675	22902	14550	7924	26989	4652	4064	4656
MEAN	188	541	307	335	274	739	485	256	900	150	131	155
MAX	300	1360	491	540	660	1700	1090	1910	2280	469	256	469
MIN	66	68	200	200	210	205	247	137	274	63	54	50
CFSM	.48	1.39	.79	.86	.70	1.90	1.24	.66	2.31	.39	.34	.40
IN.	.55	1.55	.91	.99	.73	2.18	1.39	.76	2.57	.44	.39	.44

CAL YR 1988 TOTAL 108588.0 MEAN 297 MAX 1880 MIN 7.8 CFSM .76 IN 10.36
WTR YR 1989 TOTAL 135366.0 MEAN 371 MAX 2280 MIN 50 CFSM .95 IN 12.91

04156000 TITTABAWASSEE RIVER AT MIDLAND, MI

LOCATION.--Lat 43°35'43", long 84°14'08", in NW1/4 NE1/4 sec.28, T.14 N., R.2 E., Midland County, Hydrologic Unit 04080201, on right bank 2,000 ft downstream from dam at Dow Chemical Co. in Midland, 0.7 mi upstream from Bullock Creek, 1.4 mi downstream from Chippewa River, and 23 mi upstream from mouth.

DRAINAGE AREA.--2,400 mi², approximately.

PERIOD OF RECORD.--March 1936 to current year. Gage-height records for flood seasons collected in this vicinity 1910-26, 1928, and since 1946 are contained in reports of National Weather Service.

REVISED RECORDS.--WSP 1045: 1945. WSP 1144: 1948.

GAGE.--Water-stage recorder. Datum of gage is 580.28 ft above National Geodetic Vertical Datum of 1929. Prior to Sept. 30, 1955, at datum 10.00 ft higher.

REMARKS.--Estimated daily discharges: Dec. 11, 12, Dec. 26 to Jan. 16, and Feb. 3 to Mar. 13. Records good except for estimated daily discharges, which are poor. Water is diverted from river a short distance upstream from station for industrial use. Small part returned to river 0.25 mi downstream from station, remainder returned 1 mi downstream. Extremes and daily discharges not adjusted for diversion. Prior to May 20, 1970, discharge below 4,000 ft³/s regulated by dam 2,000 ft upstream from station; fixed crest dam since. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--53 years, 1,734 ft³/s, 9.81 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 38,700 ft³/s, Sept. 13, 1986, gage height, 33.89 ft, from floodmark; minimum, 39 ft³/s, Oct. 1, 1942; minimum gage height, 8.78 ft, July 2, 3, 1988; minimum daily discharge, 111 ft³/s, Aug. 21, 1949.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 7,000 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Mar. 16	1530	9,470	19.30	June 1	1430	13,600	22.67
Mar. 29	2200	*15,600	*23.56	June 20	2200	12,800	22.16
Apr. 5	2000	8,320	18.53				

Minimum discharge, 252 ft³/s, Sept. 5, gage height, 9.10 ft; minimum daily, 293 ft³/s, Sept. 24, 30.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	500	1180	3230	700	2380	1000	6880	1260	13200	1140	469	585
2	801	1090	3200	650	3060	1200	5840	1440	11300	987	428	361
3	849	1040	2750	800	1800	900	4910	1190	7100	1260	515	316
4	1020	1160	1330	900	800	650	5300	1170	5770	811	895	295
5	1230	1140	1580	1000	600	500	7610	1370	3910	1130	1070	387
6	1240	2350	1810	900	700	650	6540	981	3900	970	627	556
7	766	5050	1910	800	900	900	4810	655	2560	1020	878	824
8	513	4410	1950	700	1100	1300	4300	1040	1990	671	980	1410
9	410	4000	1900	900	1300	1000	3930	1270	2160	543	674	778
10	615	5200	1150	1100	900	800	3580	1250	2680	660	614	589
11	918	6450	820	1300	750	700	3330	992	2450	653	647	762
12	831	5750	1000	1100	600	600	3170	771	2220	592	393	687
13	644	5100	1920	900	900	1400	3160	635	2170	598	392	734
14	703	4800	1380	700	1200	2560	2550	807	1890	595	375	753
15	501	4330	1340	600	1400	6840	3190	1050	1590	461	481	750
16	498	4080	1260	800	1000	8940	2650	1170	1990	432	628	434
17	869	3650	868	1300	700	7110	2580	958	2680	570	717	364
18	1070	3280	828	1070	600	4710	2920	871	2420	560	685	615
19	1500	2400	1310	807	550	4470	2610	1210	3240	529	375	654
20	2410	1730	1630	992	580	4260	1870	1310	11100	504	314	641
21	2280	2010	1730	807	650	3600	1570	656	11200	509	551	493
22	1070	2290	1570	714	800	3310	1240	839	6980	484	482	535
23	792	2850	1910	896	1000	2980	1080	867	5270	531	827	343
24	1250	1620	1840	1050	800	2260	1620	843	5400	470	1000	293
25	1780	2300	1320	1290	650	3810	1580	1240	3790	594	796	421
26	1880	1690	820	1180	550	7500	1520	1890	3100	516	399	445
27	1630	1380	1200	1400	650	9430	1760	1540	2550	609	352	446
28	1720	3110	1900	1210	850	10400	1670	803	1900	691	474	547
29	1130	3350	1500	849	---	14800	1470	656	1690	414	499	478
30	874	3450	1000	1350	---	14300	1280	1590	1560	355	477	293
31	1130	---	800	1980	---	9080	---	6700	---	370	450	---
TOTAL	33424	92240	48756	30747	27770	131960	96520	39034	129760	20229	18464	16789
MEAN	1078	3075	1573	992	992	4257	3217	1259	4325	653	596	560
MAX	2410	6450	3230	1980	3060	14800	7610	6700	13200	1260	1070	1410
MIN	410	1040	800	600	550	500	1080	635	1560	355	314	293
MEAN+	1086	3086	1580	996	996	4265	3225	1269	4338	665	605	567
CFSM+	.45	1.29	.66	.42	.42	1.78	1.34	.53	1.81	.28	.25	.24
IN+	.52	1.43	.76	.48	.43	2.05	1.50	.61	2.02	.32	.29	.26

CAL YR 1988 TOTAL 587401 MEAN 1605 MAX 11300 MIN 166 MEAN+ 1612 CFSM+ .67 IN+ 9.13
WTR YR 1989 TOTAL 685693 MEAN 1879 MAX 14800 MIN 293 MEAN+ 1887 CFSM+ .79 IN+ 10.67

+ Adjusted for diversion; records furnished by Dow Chemical Co.

04156100 TITTABAWASSEE RIVER NEAR MIDLAND, MI
(National stream quality accounting network station)

LOCATION.--Lat 43°34'07", long 84°11'37", in SW1/4 SE1/4 sec.35, T.14 N., R.2 E., Midland County, Hydrologic Unit 04080201; at bridge on Gordonville Road, 3.0 mi downstream from gaging station 04156000, and 20 mi upstream from mouth.

DRAINAGE AREA.--2,450 mi².

PERIOD OF RECORD.--October 1986 to current year.

REMARKS.--Bimonthly cross-sectional samples were collected at or near bridge. Water-discharge measurements were made at time of sampling. All flow except for high-water is regulated by powerplant at Sanford.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
OCT										
26...	1300	1760	727	8.35	7.0	5.0	11.0	93	K1200	3100
JAN										
18...	1145	1080	708	8.15	2.0	2.7	13.3	100	K57	K27
MAR										
15...	1045	7220	358	7.62	3.0	89	12.2	86	1400	K13000
APR										
05...	1245	9000	424	7.91	6.0	10	11.2	93	750	400
JUN										
02...	1345	E12900	485	7.93	19.5	21	6.1	68	K950	820
AUG										
16...	1400	531	1090	8.46	25.0	3.7	--	--	K69	K27

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
OCT										
26...	290	100	79	22	51	28	1	2.9	212	6
JAN										
18...	260	86	71	20	41	25	1	3.0	212	0
MAR										
15...	130	40	38	9.6	19	23	0.7	4.2	115	0
APR										
05...	170	61	49	11	20	20	0.7	3.2	130	0
JUN										
02...	220	81	63	14	17	14	0.5	3.9	163	0
AUG										
16...	280	110	72	23	110	46	3	4.1	193	5

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
OCT										
26...	184	52	96	0.2	6.6	444	0.60	2110	0.02	1.3
JAN										
18...	174	49	86	0.1	7.9	420	0.57	1220	0.01	0.83
MAR										
15...	94	28	33	0.2	6.1	213	0.29	4150	0.03	0.97
APR										
05...	107	25	48	0.1	5.5	252	0.34	6120	0.01	1.0
JUN										
02...	134	29	51	0.1	6.4	--	--	--	0.08	3.7
AUG										
16...	166	58	210	0.2	5.9	603	0.82	865	0.03	0.15

04156100 TITTABAWASSEE RIVER NEAR MIDLAND, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N)	NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHOROUS TOTAL (MG/L AS P)	PHOS-PHOROUS DIS-SOLVED (MG/L AS P)	PHOS-PHOROUS ORTHO, DIS-SOLVED (MG/L AS P)	ALUM-INUM, DIS-SOLVED (UG/L AS AL)	ARSENIC DIS-SOLVED (UG/L AS AS)	BARIUM, DIS-SOLVED (UG/L AS BA)	BERYL-LIUM, DIS-SOLVED (UG/L AS BE)
OCT										
26...	0.08	0.08	0.60	0.03	0.01	<0.01	<10	1	42	<0.5
JAN										
18...	0.20	0.18	0.50	0.03	0.02	<0.01	--	--	--	--
MAR										
15...	0.53	0.55	1.6	0.15	0.11	0.07	560	1	27	<0.5
APR										
05...	0.17	0.17	1.5	0.08	0.02	0.01	40	<1	27	<0.5
JUN										
02...	0.16	0.13	1.2	0.07	0.04	<0.01	60	<1	42	<0.5
AUG										
16...	0.15	0.18	0.50	0.09	0.03	0.02	--	--	--	--

DATE	CADMIUM DIS-SOLVED (UG/L AS CD)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COBALT, DIS-SOLVED (UG/L AS CO)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, DIS-SOLVED (UG/L AS FE)	LEAD, DIS-SOLVED (UG/L AS PB)	LITHIUM DIS-SOLVED (UG/L AS LI)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY DIS-SOLVED (UG/L AS HG)	MOLYB-DENUM, DIS-SOLVED (UG/L AS MO)
OCT										
26...	<1	<1	<3	1	26	<5	12	11	<0.1	<10
JAN										
18...	--	--	--	--	--	--	--	--	--	--
MAR										
15...	<1	1	<3	5	450	<5	<4	55	<0.1	<10
APR										
05...	<1	<1	<3	3	170	<5	7	22	0.3	<10
JUN										
02...	<1	<1	<3	7	130	2	10	12	1.3	<10
AUG										
16...	--	--	--	--	--	--	--	--	--	--

DATE	NICKEL, DIS-SOLVED (UG/L AS NI)	SELE-NIUM, DIS-SOLVED (UG/L AS SE)	SILVER, DIS-SOLVED (UG/L AS AG)	STRON-TIUM, DIS-SOLVED (UG/L AS SR)	VANA-DIUM, DIS-SOLVED (UG/L AS V)	ZINC, DIS-SOLVED (UG/L AS ZN)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
OCT									
26...	2	<1	<1.0	350	<6	27	9	43	82
JAN									
18...	--	--	--	--	--	--	4	12	71
MAR									
15...	<1	<1	1.0	170	<6	28	230	1480	86
APR									
05...	1	<1	<1.0	310	<6	7	51	1240	52
JUN									
02...	2	<1	<1.0	460	<6	77	48	--	77
AUG									
16...	--	--	--	--	--	--	14	20	--

04157000 SAGINAW RIVER AT SAGINAW, MI

LOCATION.--Lat 43°24'46", long 83°57'47", in NW1/4 SE1/4 sec.26, T.12 N., R.4 E., Saginaw County, Hydrologic Unit 04080206, on right bank 1,000 ft downstream from bridge on Rust Avenue in Saginaw, 1.9 mi downstream from Tittabawassee River, and 20.3 mi upstream from mouth.

DRAINAGE AREA.--6,060 mi², approximately.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--1904, 1908-9, 1912-13, 1916, 1918-19, 1929-30, and 1942 (flood discharge for certain periods only) in WSP 1084; December 1942 to current year (high-water periods only); no high water 1944, 1949, 1953, 1955, 1958, 1961, 1963, 1964, 1966. Gage-height records for flood seasons collected in this vicinity 1910-20, and for entire years since 1921 are contained in reports of National Weather Service.

GAGE.--Water-stage recorder. Datum of gage is 565.11 ft, International Great Lakes datum. Prior to Oct. 1, 1972, nonrecording gage at site 1.9 mi downstream at same datum. Auxiliary water-stage recorder on right bank near Aplin Beach, 19.9 mi downstream.

REMARKS.--Estimated daily discharges: Nov. 11-15. Water-discharge records fair except for estimated daily discharges, which are poor. Only daily discharges greater than 10,000 ft³/s are published. Considerable diversion through metropolitan area of Saginaw. National Weather Service gage-height telemeter at station.

COOPERATION.--Auxiliary gage-height record furnished by National Oceanic and Atmospheric Administration.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 68,000 ft³/s, Mar. 30, 1904, gage height, 24.9 ft, site then in use.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 19,600 ft³/s, Mar. 30; maximum daily gage height, 16.03 ft, Mar. 30.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1		---				---	16400	---	14900			
2		---				---	15800	---	18700			
3		---				---	14300	---	17600			
4		---				---	13600	---	15500			
5		---				---	14600	---	14000			
6		---				---	15000	---	12400			
7		---				---	13800	---	11500			
8		---				---	14000	---	10400			
9		---				---	13700	---	10000			
10		---				---	---	---	---			
11		11000				---	---	---	---			
12		14500				---	---	---	---			
13		13000				---	---	---	---			
14		11500				---	---	---	---			
15		10300				---	---	---	---			
16		---				17000	---	---	---			
17		---				13900	---	---	---			
18		---				14700	---	---	---			
19		---				---	---	---	---			
20		---				---	---	---	13000			
21		---				---	---	---	15800			
22		---				---	---	---	16000			
23		---				---	---	---	14000			
24		---				---	---	---	13400			
25		---				---	---	---	13000			
26		---				15800	---	---	12200			
27		---				16300	---	---	11000			
28		---				16000	---	---	---			
29		---				16100	---	---	---			
30		---				19600	---	---	---			
31		---				19100	---	13900	---			

04157000 SAGINAW RIVER AT SAGINAW, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1975-86, October 1988 to August 1989.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: November 1974 to September 1981.
WATER TEMPERATURE: November 1974 to September 1981.

INSTRUMENTATION.--Water-quality monitor from Nov. 6, 1976 to Sept. 30, 1981.

REMARKS.--Cross-sectional samples were collected at Rust Ave. bridge. Water-discharge meausrements were made at time of sampling.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1975, 1977, 1979): Maximum recorded (more than 20 percent missing record), 1,230 microsiemens, Jan. 5, 1977; minimum recorded (more than 20 percent missing record), 224 microsiemens, Mar. 13, 1977.
WATER TEMPERATURES (water years 1975-77, 1979): Maximum, 30.0°C, July 10, 14, 20, 1977; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
OCT 27...	1000	3580	687	8.10	6.0	11	10.2	84	320	480
APR 06...	1030	15700	515	8.02	7.0	21	11.0	93	610	930
JUN 05...	1315	14100	541	7.85	18.0	22	6.2	67	320	410
AUG 17...	1015	4890	832	8.49	24.0	25	9.4	114	K44	K38

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER WH IT FIELD MG/L AS HCO3	CAR-BONATE WATER WH IT FIELD MG/L AS CO3
OCT 27...	300	100	79	24	44	24	1	3.2	234	0
APR 06...	230	84	63	17	19	15	0.6	3.6	174	0
JUN 05...	250	86	71	18	17	13	0.5	3.2	201	0
AUG 17...	240	66	63	20	72	39	2	4.2	203	5

DATE	ALKA-LINITY WAT WH TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
OCT 27...	192	56	82	0.2	6.4	429	0.58	4150	0.02	1.7
APR 06...	143	43	43	0.1	5.5	308	0.42	13100	0.03	2.3
JUN 05...	165	39	41	0.2	7.8	338	0.46	12900	0.12	5.0
AUG 17...	174	48	140	0.3	2.7	489	0.67	6460	0.03	0.79

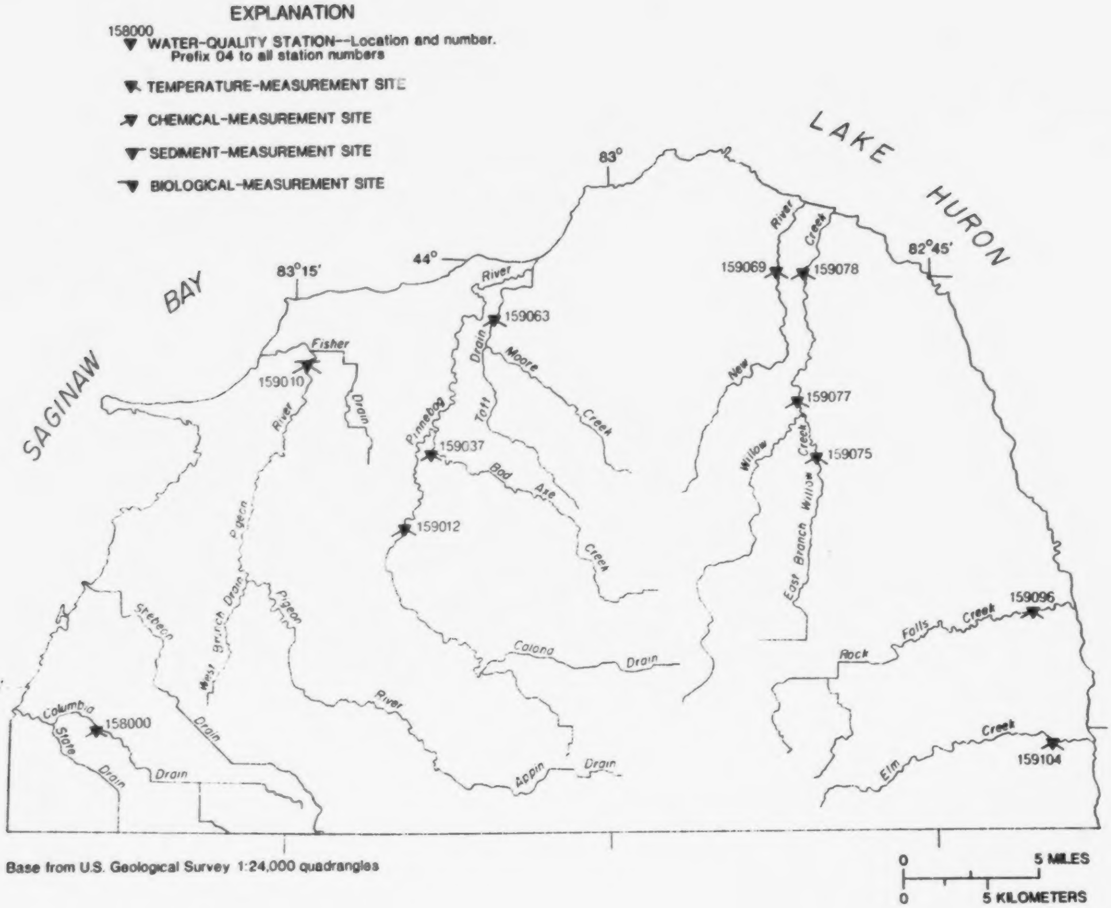
04157000 SAGINAW RIVER AT SAGINAW, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
OCT 27...	--	0.07	0.70	0.04	0.02	<0.01	<10	1	45	<0.5
APR 06...	0.14	0.11	0.80	0.07	0.03	0.02	40	1	36	<0.5
JUN 05...	0.13	0.15	1.4	0.07	0.05	<0.01	20	1	43	<0.5
AUG 17...	0.04	0.04	0.80	0.17	0.03	0.01	20	3	45	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
OCT 27...	<1	<1	<3	3	19	<5	11	10	<0.1	10
APR 06...	<1	<1	<3	4	84	<5	7	17	<0.1	<10
JUN 05...	<1	<1	<3	4	70	1	6	13	<0.1	<10
AUG 17...	<1	<1	<3	5	24	1	8	4	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
OCT 27...	2	<1	<1.0	330	<6	9	19	184	71
APR 06...	2	<1	<1.0	250	<6	8	74	3140	83
JUN 05...	1	<1	<1.0	250	<6	14	67	2550	91
AUG 17...	<1	<1	<1.0	310	<6	18	69	911	100



Base from U.S. Geological Survey 1:24,000 quadrangles

Figure 9.--Identification number and location of active surface-water-quality stations in Huron County.

04158000 COLUMBIA DRAIN NEAR SEBEWAING, MI

LOCATION.--Lat 43°43'38", long 83°23'46", in SE1/4 SE1/4 sec.10, T.15 N., R.9 E., Huron County, Hydrologic Unit 04080103, on right bank 10 ft downstream from bridge on Gettel Road, 2.4 mi upstream from mouth, and 2.5 mi southeast of Sebewaing.

DRAINAGE AREA.--33.9 mi^2.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--January 1940 to September 1954, January to September 1988. Monthly discharge only for October to December 1939, published in WSP 1307. Published as East Fork Sebewaing River (Columbia Drain) near Sebewaing 1940-54.

REVISED RECORD.--WSP 1307: 1943, 1947-1948, 1950. WSP 1727: 1952 (M). WDR MI-88: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 603.00 ft above National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to Apr. 1, 1941, nonrecording gage at same site. Prior to Jan. 1, 1988, at datum 5.0 ft higher.

REMARKS.--Estimated daily discharges: Dec. 13-18, Dec. 28 to Jan. 14, and Mar. 9-24. Water-discharge records fair except for estimated daily discharges, which are poor.

AVERAGE DISCHARGE.--16 years (water years 1940-54, 1989) 17.2 ft^3/s, 6.89 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,720 ft^3/s, Mar. 11, 1952, gage height, 11.12 ft; maximum gage height, 14.70 ft, present datum, Mar. 15, 1943, backwater from ice; no flow at times each year.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of September 1986 exceeded a stage of 18.0 ft, present datum, discharge not determined. Information supplied by local resident.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 200 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage Height (ft)	Date	Time	Discharge (ft^3/s)	Gage Height (ft)
Nov. 10	1300	1,100	9.33	Mar. 28	2200	247	7.23
Mar. 15	--	640	ice jam	Apr. 4	1700	238	7.19
Mar. 24	--	228	ice jam	June 10	0200	*1,530	*10.09

Minimum discharge. no flow July 21.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.42	6.5	15	3.0	22	.60	38	2.4	48	2.3	1.2	2.7
2	4.4	6.0	13	2.7	9.1	.58	34	2.1	26	2.0	.77	2.1
3	11	5.3	13	2.4	7.2	.51	41	1.9	21	1.7	.49	1.9
4	10	5.0	13	2.1	3.9	.50	124	1.7	65	1.8	13	1.5
5	10	10	11	1.9	2.5	.58	98	1.6	38	1.8	51	1.1
6	11	96	11	1.8	2.0	.56	55	1.7	23	1.6	15	1.0
7	8.7	58	10	3.0	1.8	.48	39	1.6	20	1.4	6.6	.94
8	6.6	39	8.7	10	1.3	.50	30	1.4	11	1.2	4.1	.94
9	5.2	33	8.9	20	.56	2.0	37	1.5	75	.97	3.0	1.3
10	4.6	576	6.9	13	.34	9.0	34	1.3	558	.82	2.2	1.4
11	4.2	229	4.9	9.0	.38	50	25	1.0	77	.62	1.7	1.4
12	3.9	87	3.2	6.5	.51	25	22	1.4	37	.51	1.3	1.0
13	3.1	74	2.8	5.5	.59	10	23	4.5	22	.32	1.0	1.0
14	2.6	62	2.4	4.5	.91	15	24	4.9	14	.19	.81	1.0
15	2.3	43	2.2	3.9	1.3	100	81	3.6	15	.13	1.2	1.1
16	2.3	56	2.0	3.2	1.4	10	47	3.2	16	.07	3.0	1.3
17	2.5	102	1.9	2.9	.98	5.0	29	2.6	16	.04	2.3	1.6
18	4.4	45	1.9	3.0	.66	3.5	21	1.9	17	.04	1.5	2.6
19	7.9	33	2.2	3.8	.50	3.0	15	1.7	31	.02	1.1	2.1
20	7.1	31	3.8	5.3	.54	2.8	11	2.0	91	.01	.96	1.6
21	5.9	39	6.3	4.6	.63	2.7	8.2	2.9	38	.00	.80	1.4
22	5.9	34	3.5	1.9	.71	2.6	6.6	2.6	25	.01	.98	1.2
23	7.0	27	4.3	2.5	.72	2.5	5.2	1.8	22	.01	4.8	1.0
24	16	23	6.1	3.4	.54	25	4.5	1.4	19	.03	5.3	.85
25	35	20	5.1	3.7	.41	143	4.0	1.7	12	.02	2.3	.74
26	28	19	3.3	3.4	.46	73	4.1	3.4	8.7	.03	1.6	.64
27	19	22	3.6	4.2	.54	77	4.3	2.6	6.9	42	1.2	.56
28	13	24	5.0	7.4	.56	125	3.6	1.5	4.8	12	1.1	.49
29	10	19	4.5	6.6	---	152	3.2	1.0	3.6	4.1	2.2	.41
30	8.1	18	4.0	13	---	73	2.8	3.3	2.8	2.4	5.4	.40
31	6.9	---	3.5	26	---	53	---	51	---	1.7	3.4	---
TOTAL	267.02	1841.8	187.0	184.2	63.04	968.41	874.5	117.2	1363.8	79.84	141.31	37.27
MEAN	8.61	61.4	6.03	5.94	2.25	31.2	29.2	3.78	45.5	2.58	4.56	1.24
MAX	35	576	15	26	22	152	124	51	558	42	51	2.7
MIN	.42	5.0	1.9	1.8	.34	.48	2.8	1.0	2.8	.00	.49	.40
CFSM	.25	1.81	.18	.18	.07	.92	.86	.11	1.34	.08	.14	.04
IN.	.29	2.02	.21	.20	.07	1.06	.96	.13	1.50	.09	.16	.04

CAL YR 1988 TOTAL 5492.64 MEAN 15.0 MAX 576 MIN .00 CFSM .44 IN 6.03
WTR YR 1989 TOTAL 6125.39 MEAN 16.8 MAX 576 MIN .00 CFSM .50 IN 6.72

04158000 COLUMBIA DRAIN NEAR SEBEWAING, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1988 to April 1989 (discontinued).

REMARKS.--Water-discharge measurements were made at time of sampling. Cross-sectional samples were collected near bridge.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	HARD-NESS TOTAL (MG/L AS CACO3)
OCT									
18...	1600	4.9	796	8.38	14.0	4.5	15.3	152	410
APR									
14...	0945	20	894	8.08	4.5	--	13.2	105	--

DATE	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER WH IT FIELD MG/L AS HCO3	CAR-BONATE WATER WH IT FIELD MG/L AS CO3
OCT									
18...	200	110	33	17	8	0.4	3.7	242	7
APR									
14...	--	--	--	--	--	--	--	266	0

DATE	ALKA-LINITY WAT WH TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	NITRO-GEN, NITRITE TOTAL (MG/L AS N)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
OCT									
18...	210	130	52	0.2	2.2	0.04	0.04	6.3	5.7
APR									
14...	218	--	--	--	--	0.03	0.03	--	13

DATE	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N)	NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHOROUS TOTAL (MG/L AS P)	PHOS-PHOROUS DIS-SOLVED (MG/L AS P)	PHOS-PHOROUS ORTHO, DIS-SOLVED (MG/L AS P)	ALUM-INUM, DIS-SOLVED (UG/L AS AL)	ARSENIC DIS-SOLVED (UG/L AS AS)	BARIUM, DIS-SOLVED (UG/L AS BA)
OCT									
18...	--	0.03	0.80	0.02	0.02	<0.01	20	1	27
APR									
14...	0.04	0.05	1.0	0.02	0.01	<0.01	--	--	--

DATE	BERYL-LIUM, DIS-SOLVED (UG/L AS BE)	CADMIUM DIS-SOLVED (UG/L AS CD)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COBALT, DIS-SOLVED (UG/L AS CO)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, DIS-SOLVED (UG/L AS FE)	LEAD, DIS-SOLVED (UG/L AS PB)	LITHIUM DIS-SOLVED (UG/L AS LI)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)
OCT									
18...	0.9	1	<1	<3	3	31	<5	12	4
APR									
14...	--	--	--	--	--	--	--	--	--

DATE	MERCURY DIS-SOLVED (UG/L AS HG)	MOLYB-DENUM, DIS-SOLVED (UG/L AS MO)	NICKEL, DIS-SOLVED (UG/L AS NI)	SELE-NIUM, DIS-SOLVED (UG/L AS SE)	SILVER, DIS-SOLVED (UG/L AS AG)	STRON-TIUM, DIS-SOLVED (UG/L AS SR)	VANA-DIUM, DIS-SOLVED (UG/L AS V)	ZINC, DIS-SOLVED (UG/L AS ZN)
OCT								
18...	0.2	<10	2	2	<1.0	300	<6	18
APR								
14...	--	--	--	--	--	--	--	--

04159010 PIGEON RIVER NEAR CASEVILLE, MI

(National stream quality accounting network station)

LOCATION.--Lat 43°56'22", long 83°14'30", in SW1/4 NW1/4 sec.31, T.18 N., R.11 E., Huron County, Hydrologic Unit 04080103, on left bank at upstream side of bridge on Kinde Road, 1.5 mi east of Caseville, and 3.1 mi upstream from mouth.

DRAINAGE AREA.--125 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1986 to current year.

GAGE.--Water-stage recorder. Datum of gage 578.43 ft above National Geodetic Vertical Datum of 1929. Prior to June 10, 1987, nonrecording gage at same datum.

REMARKS.--Estimated daily discharges: Oct. 25 to May 2. Water discharge records fair except for estimated daily discharges, which are poor. Some regulation at low flows.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 1,800 ft³/s, Oct. 1, 1986; no flow at times each year.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood in September 1986 reached a stage of 18.2 ft, from floodmark, and discharge of 2,900 ft³/s, from indirect computation of discharge.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 1,100 ft³/s, Nov. 10; no flow July 25, 26.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	7.1	58	75	15	90	3.0	230	23	45	19	2.8	15
2	23	54	65	14	50	2.8	200	21	72	16	2.0	12
3	86	50	63	13	30	2.6	240	19	63	14	2.4	9.7
4	103	47	68	11	20	2.5	720	16	90	14	4.3	8.1
5	94	200	52	10	13	3.0	600	15	177	11	15	5.8
6	95	580	51	9.0	11	2.7	300	14	145	9.8	28	5.2
7	106	400	47	15	9.0	2.5	280	14	84	9.2	37	5.0
8	95	300	42	50	7.0	3.0	170	12	59	7.8	15	4.9
9	76	210	44	100	3.0	6.6	220	14	51	6.4	9.8	7.0
10	54	1100	33	60	1.8	30	200	14	98	4.9	7.2	6.4
11	42	800	24	40	2.0	250	170	11	425	4.7	5.0	5.9
12	34	520	15	30	2.5	100	140	12	240	3.4	3.4	5.5
13	31	400	13	25	3.5	50	130	14	106	2.6	2.8	5.7
14	26	350	12	20	4.5	80	140	20	67	2.7	3.6	5.9
15	22	300	11	17	7.0	500	280	21	65	2.6	3.9	5.6
16	21	350	10	15	6.0	40	480	18	87	2.5	3.9	4.7
17	23	620	10	14	4.5	22	160	17	102	2.5	7.0	5.0
18	27	270	10	16	3.5	18	110	17	123	2.9	8.3	5.5
19	37	200	11	19	2.5	16	90	17	125	2.5	5.6	6.4
20	68	190	16	25	2.9	15	75	17	138	2.1	4.8	6.3
21	66	240	30	15	3.3	14	64	17	168	1.9	3.1	2.9
22	50	200	17	9.0	3.7	13	56	20	135	1.5	2.5	3.4
23	47	160	20	13	3.3	12	51	20	112	.78	4.5	2.4
24	71	120	30	18	2.8	130	45	17	149	.12	11	2.3
25	320	100	25	17	2.1	700	41	17	136	.00	24	1.9
26	250	90	16	16	2.4	350	39	18	83	.00	14	1.6
27	180	105	18	20	2.8	900	44	19	57	1.8	8.6	1.5
28	130	120	25	40	3.1	650	50	17	41	3.9	6.8	1.5
29	100	100	22	35	---	520	31	18	32	3.0	8.5	1.5
30	80	85	19	70	---	400	26	15	24	2.9	11	1.5
31	65	---	17	130	---	340	---	17	---	3.0	17	---
TOTAL	2429.1	8319	911	901.0	297.2	5178.7	5382	521	3299	159.50	282.8	156.1
MEAN	78.4	277	29.4	29.1	10.6	167	179	16.8	110	5.15	9.12	5.20
MAX	320	1100	75	130	90	900	720	23	425	19	37	15
MIN	7.1	47	10	9.0	1.8	2.5	26	11	24	.00	2.0	1.5
CFSM	.63	2.22	.24	.23	.09	1.34	1.43	.13	.88	.04	.07	.04
IN.	.72	2.48	.27	.27	.09	1.54	1.60	.16	.98	.05	.08	.05

CAL YR 1988 TOTAL 25144.46 MEAN 68.7 MAX 1100 MIN .00 CFSM .55 IN 7.48
WTR YR 1989 TOTAL 27836.40 MEAN 76.3 MAX 1100 MIN .00 CFSM .61 IN 8.28

04159010 PIGEON RIVER NEAR CASEVILLE, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--January 1978 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: April 1978 to September 1981.
WATER TEMPERATURE: April 1978 to September 1981.

REMARKS.--Quarterly cross-sectional samples were collected at or near bridge.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water year 1980): Maximum daily recorded (more than 20 percent missing record), 2,000 microsiemens, Oct. 20, 1979; minimum daily recorded (more than 20 percent missing record), 175 microsiemens, Mar. 6, 1979.
WATER TEMPERATURE (water year 1978): Maximum daily recorded (more than 20 percent missing record), 27.5°C, July 7, 1978; minimun daily recorded (more than 20 percent missing record), 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
OCT										
18...	1300	26	937	8.21	10.5	2.5	7.7	71	3600	K14000
JAN										
19...	1430	19	831	7.98	1.0	4.0	13.5	98	K73	1100
APR										
12...	1330	137	950	8.19	4.5	6.0	12.5	99	K44	K170
AUG										
15...	1400	4.0	572	8.25	22.0	2.2	9.0	106	410	410

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
OCT										
18...	470	200	130	36	19	8	0.4	5.5	331	0
JAN										
19...	420	150	120	29	17	8	0.4	3.6	334	0
APR										
12...	460	220	130	34	24	10	0.5	3.6	302	0
AUG										
15...	270	93	75	20	13	9	0.4	6.9	216	0

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE TOTAL (MG/L AS N)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)
OCT										
18...	271	120	57	0.2	5.6	611	0.83	42.9	0.04	0.04
JAN										
19...	274	120	41	0.2	7.4	536	0.73	27.5	--	0.02
APR										
12...	248	95	60	0.2	4.4	581	0.79	215	0.04	0.05
AUG										
15...	177	68	29	0.3	2.7	356	0.48	3.84	--	0.01

04159010 PIGEON RIVER NEAR CASEVILLE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)
OCT										
18...	9.0	8.8	0.03	0.04	1.4	0.08	0.06	0.04	10	1
JAN										
19...	--	3.3	0.16	0.15	1.0	0.06	0.04	0.03	<10	1
APR										
12...	13.0	14.0	0.22	0.24	1.3	0.12	0.07	0.07	<10	<1
AUG										
15...	--	1.5	0.03	0.03	0.30	0.10	0.07	0.05	<10	2

DATE	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)
OCT										
18...	56	<0.5	5	<1	<3	7	31	<5	12	10
JAN										
19...	50	<0.5	<1	<1	<3	1	20	<5	12	52
APR										
12...	47	<0.5	<1	<1	<3	<1	9	<5	10	19
AUG										
15...	37	<0.5	<1	<1	<3	4	15	<1	7	8

DATE	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)
OCT										
18...	<0.1	<10	2	<1	<1.0	320	<6	14	30	2.1
JAN										
19...	<0.1	<10	<1	<1	<1.0	300	<6	7	15	0.77
APR										
12...	<0.1	<10	<1	2	<1.0	300	<6	12	19	7.0
AUG										
15...	<0.1	<10	<1	<1	<1.0	250	<6	40	5	0.05

DATE	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
OCT	
18...	79
JAN	
19...	71
APR	
12...	76
AUG	
15...	51

04159012 PINNEBOG RIVER NEAR ELKTON, MI

LOCATION.--Lat 43°50'53", long 83°09'44", in NE1/4 NE1/4 sec.3, T.16 N., R.11 E., Huron County, Hydrologic Unit 04080103, at bridge on Berne Road, 2.3 mi northeast of Elkton.

DRAINAGE AREA.--73.3 mi².

PERIOD OF RECORD.--Water years 1988 to April 1989 (discontinued).

REMARKS.--Water-discharge measurements were made at time of sampling. Cross-sectional samples were collected near bridge.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	BICAR-BONATE WATER WH IT FIELD MG/L AS HCO3	CAR-BONATE WATER WH IT FIELD MG/L AS CO3	ALKA-LINITY WAT WH TOT IT FIELD MG/L AS CACO3
OCT										
20...	0945	42	897	8.23	7.0	10.2	86	327	0	268
APR										
14...	1015	65	901	8.21	4.5	12.5	99	322	0	264

DATE	NITRO-GEN, NITRITE TOTAL (MG/L AS N)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N)	NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHOROUS TOTAL (MG/L AS P)	PHOS-PHOROUS DIS-SOLVED (MG/L AS P)	PHOS-PHOROUS ORTHO, DIS-SOLVED (MG/L AS P)
OCT										
20...	0.02	0.03	13	14	0.03	0.03	0.90	0.04	0.02	0.01
APR										
14...	0.02	0.02	--	8.8	0.13	0.14	1.9	0.25	0.19	0.17

04159037 BAD AXE CREEK NEAR ELKTON, MI

LOCATION.--Lat 43°53'28", long 83°08'28", in NW1/4 NW1/4 sec.24, T.17 N., R.11 E., Huron County, Hydrologic Unit 04080103, at bridge on Filion Road, 5.5 mi northeast of Elkton.

DRAINAGE AREA.--28.3 mi².

PERIOD OF RECORD.--Water year 1988 to April 1989 (discontinued).

REMARKS.--Water-discharge measurements were made at time of sampling. Cross-sectional samples were collected near bridge.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	BICAR-BONATE WATER WH IT FIELD MG/L AS HCO3	CAR-BONATE WATER WH IT FIELD MG/L AS CO3	ALKA-LINITY WAT WH TOT IT FIELD MG/L AS CACO3
OCT										
18...	1530	12	1160	8.04	11.5	9.1	86	343	0	281
APR										
13...	1530	31	834	8.16	7.0	12.8	108	305	0	250

DATE	NITRO-GEN, NITRITE TOTAL (MG/L AS N)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N)	NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHOROUS TOTAL (MG/L AS P)	PHOS-PHOROUS DIS-SOLVED (MG/L AS P)	PHOS-PHOROUS ORTHO, DIS-SOLVED (MG/L AS P)
OCT										
18...	0.37	0.36	7.6	7.3	--	0.04	1.2	0.14	0.11	0.08
APR										
13...	0.62	0.65	10	11	0.11	0.12	2.0	0.09	0.05	0.04

04159063 TAFT DRAIN NEAR PINNEBOG, MI

LOCATION.--Lat 43°57'52", long 83°05'53", in SE1/4 SW1/4 sec.20, T.18 N., R.12 E., Huron County, Hydrologic Unit 04080103, at bridge on Oak Beach Road, 2.0 mi northeast of Pinnebog.

DRAINAGE AREA.--31.1 mi².

PERIOD OF RECORD.--Water years 1988 to April 1989 (discontinued).

REMARKS.--Water-discharge measurements were made at times of sampling. Cross-sectional samples were collected near bridge.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3
OCT										
18...	1430	16	765	8.24	11.5	6.0	10.0	94	390	170
APR										
13...	1400	40	720	7.80	6.5	--	16.0	132	--	--

DATE	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER WH IT FIELD MG/L AS HCO3	CAR-BONATE WATER WH IT FIELD MG/L AS CO3	ALKA-LINITY WAT WH TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)
OCT										
18...	110	27	11	6	0.3	5.5	257	0	211	71
APR										
13...	--	--	--	--	--	--	283	0	232	--

DATE	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE TOTAL (MG/L AS N)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
OCT										
18...	48	0.2	6.1	405	0.55	17.5	0.06	0.06	11	11
APR										
13...	--	--	--	--	--	--	0.02	0.02	8.7	8.0

DATE	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N)	NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHOROUS TOTAL (MG/L AS P)	PHOS-PHOROUS DIS-SOLVED (MG/L AS P)	PHOS-PHOROUS ORTHO, DIS-SOLVED (MG/L AS P)	ALUM-INUM, DIS-SOLVED (UG/L AS AL)	ARSENIC DIS-SOLVED (UG/L AS AS)	BARIUM, DIS-SOLVED (UG/L AS BA)	BERYL-LIUM, DIS-SOLVED (UG/L AS BE)
OCT										
18...	--	0.05	1.6	0.04	0.03	<0.01	<10	1	37	<0.5
APR										
13...	0.04	0.04	1.4	0.03	0.02	<0.01	--	--	--	--

DATE	CADMIUM DIS-SOLVED (UG/L AS CD)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COBALT, DIS-SOLVED (UG/L AS CO)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, DIS-SOLVED (UG/L AS FE)	LEAD, DIS-SOLVED (UG/L AS PB)	LITHIUM DIS-SOLVED (UG/L AS LI)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY DIS-SOLVED (UG/L AS HG)	MOLYB-DENUM, DIS-SOLVED (UG/L AS MO)
OCT										
18...	4	<1	<3	3	31	<5	8	8	0.2	<10
APR										
13...	--	--	--	--	--	--	--	--	--	--

DATE	NICKEL, DIS-SOLVED (UG/L AS NI)	SELE-NIUM, DIS-SOLVED (UG/L AS SE)	SILVER, DIS-SOLVED (UG/L AS AG)	STRON-TIUM, DIS-SOLVED (UG/L AS SR)	VANA-DIUM, DIS-SOLVED (UG/L AS V)	ZINC, DIS-SOLVED (UG/L AS ZN)
OCT						
18...	<1	1	<1.0	180	<6	20
APR						
13...	--	--	--	--	--	--

04159069 NEW RIVER NEAR HURON CITY, MI

LOCATION.--Lat 44°00'05", long 82°52'25", in SW1/4 SE1/4 sec.7, T.18 N., R.14 E., Huron County, Hydrologic Unit 04080104, at bridge on Stoddard Road, 2.8 mi southwest of Huron City.

DRAINAGE AREA.--22.1 mi².

PERIOD OF RECORD.--Water years 1988 to April 1989 (discontinued).

REMARKS.--Water-discharge measurements were made at time of sampling. Cross-sectional samples were collected near bridge.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DISCHARGE, INST. CUBIC FEET PER SECOND	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	TEMPERATURE WATER (DEG C)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	BICARBONATE WATER WH IT FIELD MG/L AS HCO3	CARBONATE WATER WH IT FIELD MG/L AS CO3	ALKALINITY WAT WH TOT IT FIELD MG/L AS CACO3
OCT										
19...	1030	5.3	802	8.14	10.0	8.8	80	280	0	230
APR										
13...	1100	19	752	8.22	4.0	13.4	104	290	0	238

DATE	NITROGEN, NITRITE TOTAL (MG/L AS N)	NITROGEN, NITRITE DISSOLVED (MG/L AS N)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)
OCT										
19...	0.18	0.18	15	14	0.32	0.33	2.5	0.13	0.10	0.06
APR										
13...	0.03	0.03	--	11	0.04	0.05	1.0	0.03	0.03	0.03

04159075 EAST BRANCH WILLOW CREEK NEAR REDMAN, MI

LOCATION.--Lat 43°53'59", long 82°50'22", in SW1/4 SW1/4 sec.16, T.17 N., R.14 E., Huron County, Hydrologic Unit 04080104, at bridge on Filion Road, 2.1 mi south of Redman.

DRAINAGE AREA.--32.0 mi².

PERIOD OF RECORD.--Water years 1988 to April 1989 (discontinued).

REMARKS.--Water-discharge measurements were made at time of sampling. Cross-sectional samples were collected near bridge.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	BICAR-BONATE WATER WH IT FIELD MG/L AS HCO3	CAR-BONATE WATER WH IT FIELD MG/L AS CO3	ALKA-LINITY WAT WH TOT IT FIELD MG/L AS CACO3
OCT										
20...	1015	8.5	927	8.18	7.0	--	--	301	0	247
APR										
13...	1000	38	831	7.92	2.5	14.2	106	291	0	239

DATE	NITRO-GEN, NITRITE TOTAL (MG/L AS N)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N)	NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHOROUS TOTAL (MG/L AS P)	PHOS-PHOROUS DIS-SOLVED (MG/L AS P)	PHOS-PHOROUS ORTHO, DIS-SOLVED (MG/L AS P)
OCT										
20...	0.05	0.06	15	15	0.02	0.02	1.6	0.06	0.05	0.03
APR										
13...	0.03	0.03	10	11	0.04	0.05	1.5	0.03	0.02	0.01

04159077 WILLOW CREEK NEAR REDMAN, MI

LOCATION.--Lat 43°54'49", long 82°51'13", in NW1/4 NE1/4 sec.8, T.17 N., R.14 E., Huron County, Hydrologic Unit 04080104, at bridge on Redman Road, 1.0 mi west of Redman.

DRAINAGE AREA.--69.8 mi².

PERIOD OF RECORD.--Water years 1988 to April 1989 (discontinued).

REMARKS.--Water-discharge measurements were made at time of sampling. Cross-sectional samples were collected near bridge.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DISCHARGE, INST. CUBIC FEET PER SECOND	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	TEMPERATURE WATER (DEG C)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	BICARBONATE WATER WH IT FIELD MG/L AS HCO3	CARBONATE WATER WH IT FIELD MG/L AS CO3	ALKALINITY WAT WH TOT IT FIELD MG/L AS CACO3
OCT 19...	1500	16	853	8.11	10.0	8.2	74	257	0	211
APR 13...	1100	86	777	8.05	3.5	14.1	108	278	0	228

DATE	NITROGEN, NITRITE TOTAL (MG/L AS N)	NITROGEN, NITRITE DISSOLVED (MG/L AS N)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)
OCT 19...	0.16	0.16	7.5	7.4	0.03	0.04	2.3	0.26	0.23	0.14
APR 13...	0.03	0.03	--	9.7	0.04	0.05	1.7	0.08	0.02	0.01

04159078 WILLOW CREEK NEAR HURON CITY, MI

LOCATION.--Lat 44°00'02", long 82°51'15", in NW1/4 NE1/4 sec.17, T.18 N., R.14 E., Huron County, Hydrologic Unit 04080104, at bridge on Stoddard Road, 2.3 mi southwest of Huron City.

DRAINAGE AREA.--74.4 mi².

PERIOD OF RECORD.--Water years 1988 to April 1989 (discontinued).

REMARKS.--Water-discharge measurements were made at time of sampling. Cross-sectional samples were collected near bridge.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND	SPE- CIFIC CON- DUCT- ANCE (US/CM)	PH (STAND- ARD UNITS)	TEMPER- ATURE WATER (DEG C)	TUR- BID- ITY (NTU)	OXYGEN, DIS- SOLVED (MG/L)	OXYGEN, DIS- SOLVED (PER- CENT SATUR- ATION)	HARD- NESS TOTAL (MG/L AS CACO3)	HARD- NESS NONCARB WH WAT TOT FLD MG/L AS CACO3
OCT 19...	1330	14	913	8.36	10.5	2.8	11.8	108	440	210
APR 13...	1400	83	760	8.30	6.5	--	13.5	112	--	--

DATE	CALCIUM DIS- SOLVED (MG/L AS CA)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG)	SODIUM, DIS- SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD- SORP- TION RATIO	POTAS- SIUM, DIS- SOLVED (MG/L AS K)	BICAR- BONATE WATER WH IT FIELD MG/L AS HCO3	CAR- BONATE WATER WH IT FIELD MG/L AS CO3	ALKA- LINITY WAT WH TOT IT FIELD MG/L AS CACO3	SULFATE DIS- SOLVED (MG/L AS SO4)
OCT 19...	120	35	27	11	0.6	10	271	7	234	140
APR 13...	--	--	--	--	--	--	276	0	226	--

DATE	CHLO- RIDE, DIS- SOLVED (MG/L AS CL)	FLUO- RIDE, DIS- SOLVED (MG/L AS F)	SILICA, DIS- SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L)	SOLIDS, DIS- SOLVED (TONS PER AC-FT)	SOLIDS, DIS- SOLVED (TONS PER DAY)	NITRO- GEN, NITRITE TOTAL (MG/L AS N)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N)	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N)
OCT 19...	74	0.2	0.55	568	0.77	21.5	0.13	0.13	8.5	8.1
APR 13...	--	--	--	--	--	--	0.02	0.02	--	9.5

DATE	NITRO- GEN, AMMONIA TOTAL (MG/L AS N)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS- PHOROUS TOTAL (MG/L AS P)	PHOS- PHOROUS DIS- SOLVED (MG/L AS P)	PHOS- PHOROUS ORTHO, DIS- SOLVED (MG/L AS P)	ALUM- INUM, DIS- SOLVED (UG/L AS AL)	ARSENIC DIS- SOLVED (UG/L AS AS)	BARIUM, DIS- SOLVED (UG/L AS BA)	BERYL- LIUM, DIS- SOLVED (UG/L AS BE)
OCT 19...	<0.01	0.02	1.1	0.04	0.03	<0.01	10	1	48	<0.5
APR 13...	0.04	0.04	1.2	0.03	0.02	0.01	--	--	--	--

DATE	CADMIUM DIS- SOLVED (UG/L AS CD)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR)	COBALT, DIS- SOLVED (UG/L AS CO)	COPPER, DIS- SOLVED (UG/L AS CU)	IRON, DIS- SOLVED (UG/L AS FE)	LEAD, DIS- SOLVED (UG/L AS PB)	LITHIUM DIS- SOLVED (UG/L AS LI)	MANGA- NESE, DIS- SOLVED (UG/L AS MN)	MERCURY DIS- SOLVED (UG/L AS HG)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO)
OCT 19...	4	<1	<3	3	58	<5	13	6	0.1	<10
APR 13...	--	--	--	--	--	--	--	--	--	--

DATE	NICKEL, DIS- SOLVED (UG/L AS NI)	SELE- NIUM, DIS- SOLVED (UG/L AS SE)	SILVER, DIS- SOLVED (UG/L AS AG)	STRON- TIUM, DIS- SOLVED (UG/L AS SR)	VANA- DIUM, DIS- SOLVED (UG/L AS V)	ZINC, DIS- SOLVED (UG/L AS ZN)
OCT 19...	<1	<1	<1.0	360	<6	13
APR 13...	--	--	--	--	--	--

04159096 ROCK FALLS CREEK NEAR HARBOR BEACH, MI

LOCATION.--Lat 43°48'40", long 82°39'45", in NW1/4 SW1/4 sec.24, T.16 N., R.15 E., Huron County, Hydrologic Unit 04080104, at bridge on Schock Road, 2.4 mi southwest of Harbor Beach.

DRAINAGE AREA.--30.4 mi².

PERIOD OF RECORD.--Water years 1988 to April 1989 (discontinued).

REMARKS.--Water-discharge measurements were made at time of sampling. Cross-sectional samples were collected near bridge.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	BICAR-BONATE WATER WH IT FIELD MG/L AS HCO3	CAR-BONATE WATER WH IT FIELD MG/L AS CO3	ALKA-LINITY WAT WH TOT IT FIELD MG/L AS CACO3
OCT 19...	1145	2.8	796	8.06	9.0	9.9	88	284	0	233
APR 12...	1400	36	825	8.30	4.0	14.5	113	315	0	258

DATE	NITRO-GEN, NITRITE TOTAL (MG/L AS N)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N)	NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHOROUS TOTAL (MG/L AS P)	PHOS-PHOROUS DIS-SOLVED (MG/L AS P)	PHOS-PHOROUS ORTHO, DIS-SOLVED (MG/L AS P)
OCT 19...	0.02	0.02	3.4	3.4	0.03	--	0.70	0.02	0.02	<0.01
APR 12...	0.03	0.03	10	11	0.07	0.08	0.80	0.02	0.02	0.01

04159104 ELM CREEK NEAR WHITE ROCK, MI

LOCATION.--Lat 43°44'24", long 82°38'33", in SE1/4 NE1/4 sec.13, T.15 N., R.15 E., Huron County, Hydrologic Unit 04080104, at bridge on Edwards Road, 2.8 mi northwest of White Rock.

DRAINAGE AREA.--24.4 mi^2.

PERIOD OF RECORD.--Water years 1988 to April 1989 (discontinued).

REMARKS.--Water-discharge measurements were made at time of sampling. Cross-sectional samples were collected near bridge.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3
OCT 19...	1030	2.2	982	8.27	9.0	1.6	9.3	83	460	170
APR 12...	1300	20	879	8.34	3.5	--	13.5	104	--	--

DATE	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER WH IT FIELD MG/L AS HCO3	CAR-BONATE WATER WH IT FIELD MG/L AS CO3	ALKA-LINITY WAT WH TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)
OCT 19...	120	38	28	11	0.6	11	355	0	291	130
APR 12...	--	--	--	--	--	--	305	1	252	--

DATE	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE TOTAL (MG/L AS N)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
OCT 19...	68	0.3	2.6	606	0.82	3.60	0.43	0.42	3.8	3.7
APR 12...	--	--	--	--	--	--	0.08	0.09	13	14

DATE	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N)	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHOROUS TOTAL (MG/L AS P)	PHOS-PHOROUS DIS-SOLVED (MG/L AS P)	PHOS-PHOROUS ORTHO, DIS-SOLVED (MG/L AS P)	ALUM-INUM, DIS-SOLVED (UG/L AS AL)	ARSENIC DIS-SOLVED (UG/L AS AS)	BARIUM, DIS-SOLVED (UG/L AS BA)	BERYL-LIUM, DIS-SOLVED (UG/L AS BE)	CADMIUM DIS-SOLVED (UG/L AS CD)
OCT 19...	0.40	1.8	0.10	0.05	<0.01	<10	2	78	<0.5	4
APR 12...	0.07	1.3	0.05	0.03	0.02	--	--	--	--	--

DATE	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COBALT, DIS-SOLVED (UG/L AS CO)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, DIS-SOLVED (UG/L AS FE)	LEAD, DIS-SOLVED (UG/L AS PB)	LITHIUM DIS-SOLVED (UG/L AS LI)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY DIS-SOLVED (UG/L AS HG)	MOLYB-DENUM, DIS-SOLVED (UG/L AS MO)
OCT 19...	1	<3	3	76	<5	17	16	<0.1	<10
APR 12...	--	--	--	--	--	--	--	--	--

DATE	NICKEL, DIS-SOLVED (UG/L AS NI)	SELE-NIUM, DIS-SOLVED (UG/L AS SE)	SILVER, DIS-SOLVED (UG/L AS AG)	STRON-TIUM, DIS-SOLVED (UG/L AS SR)	VANA-DIUM, DIS-SOLVED (UG/L AS V)	ZINC, DIS-SOLVED (UG/L AS ZN)
OCT 19...	1	<1	<1.0	430	<6	12
APR 12...	--	--	--	--	--	--

04159130 ST. CLAIR RIVER AT PORT HURON, MI
(National stream quality accounting network station)

LOCATION.--Lat 42°59'19", long 82°25'29", in SE1/4 sec.3, T.6 N., R.17 E., St. Clair County, Hydrologic Unit 04090001, at Port Huron municipal water-treatment plant in Port Huron.

DRAINAGE AREA.--222,400 mi^2, approximately.

PERIOD OF RECORD.--Water years 1970-73, 1978 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: April 1978 to September 1981.
WATER TEMPERATURE: April 1978 to September 1981.

REMARKS.--Bimonthly samples were collected near the Port Huron municipal water-treatment plant. Daily-mean water discharge is reported at sample time.

COOPERATION.--Water discharges were provided by the National Oceanic and Atmospheric Administration.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1979-81): Maximum daily, 260 microsiemens, Dec. 18, 1980; minimum daily, 194 microsiemens, Jan. 27, 28, 1980.
WATER TEMPERATURE (water years 1979-81): Maximum daily, 24.0°C, Aug. 14-16, 1980; minimum daily, 0.0°C on many days during winter.

EXTREMES OUTSIDE PERIOD OF DAILY RECORD.--A specific conductance of 164 microsiemens was measured July 3, 1972.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DISCHARGE, IN CUBIC FEET PER SECOND	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	TEMPERATURE WATER (DEG C)	TURBIDITY (NTU)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	COLIFORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
NOV 04...	1200	190000	209	8.1	9.5	1.1	9.3	85	K4	K1
DEC 19...	1115	186000	211	8.1	1.5	1.5	13.4	98	<1	K1
MAR 08...	1300	160000	221	8.1	0.0	0.3	--	--	<1	<1
MAY 16...	1100	199000	209	8.3	8.5	1.2	11.5	100	<1	<1
JUN 27...	1330	197000	205	8.4	17.0	0.4	9.0	96	<1	K2
SEP 22...	0800	203000	208	8.4	18.5	0.4	9.2	101	K2	K6

DATE	HARDNESS TOTAL (MG/L AS CACO3)	HARDNESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	BICARBONATE WATER DIS IT FIELD MG/L AS HCO3	CARBONATE WATER DIS IT FIELD MG/L AS CO3
NOV 04...	110	25	29	7.9	3.7	7	0.2	1.0	98	0
DEC 19...	98	16	27	7.5	3.5	7	0.2	0.7	100	0
MAR 08...	110	22	31	8.0	4.0	7	0.2	1.0	107	0
MAY 16...	100	21	28	7.5	3.6	7	0.2	0.9	98	0
JUN 27...	100	16	28	7.3	3.9	8	0.2	0.9	98	2
SEP 22...	100	22	28	7.7	3.8	7	0.2	0.9	93	2

DATE	ALKALINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, DISSOLVED (TONS PER AC-FT)	SOLIDS, DISSOLVED (TONS PER DAY)	NITROGEN, NITRITE DISSOLVED (MG/L AS N)
NOV 04...	80	17	6.0	0.1	1.3	118	0.16	60500	<0.01
DEC 19...	82	19	5.9	0.1	1.4	114	0.16	57300	<0.01
MAR 08...	88	21	6.6	0.1	1.2	121	0.16	52300	<0.01
MAY 16...	80	16	5.9	0.1	0.65	113	0.15	60700	<0.01
JUN 27...	84	14	6.3	0.1	0.64	117	0.16	62200	<0.01
SEP 22...	80	16	5.9	0.1	0.92	112	0.15	61400	<0.01

04159130 ST. CLAIR RIVER AT PORT HURON, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)
NOV									
04...	0.27	<0.01	<0.01	<0.20	<0.01	<0.01	<0.01	<10	<1
DEC									
19...	0.31	<0.01	<0.01	0.30	<0.01	<0.01	<0.01	--	--
MAR									
08...	0.37	<0.01	<0.01	0.40	<0.01	<0.01	0.01	<10	<1
MAY									
16...	0.25	0.01	<0.01	<0.20	0.01	<0.01	<0.01	<10	<1
JUN									
27...	0.30	<0.01	0.01	<0.20	0.01	0.03	<0.01	20	1
SEP									
22...	0.28	0.02	<0.01	0.30	<0.01	<0.01	<0.01	<10	<1

DATE	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)
NOV									
04...	15	<0.5	<1	<1	<3	<1	4	<5	<4
DEC									
19...	--	--	--	--	--	--	--	--	--
MAR									
08...	16	<0.5	<1	<1	<3	1	4	<5	5
MAY									
16...	16	<0.5	<1	<1	<3	<1	4	<1	6
JUN									
27...	14	<0.5	<1	1	<3	1	5	<1	<4
SEP									
22...	24	<0.5	<1	<1	<3	1	6	<1	<4

DATE	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)
NOV									
04...	<1	<0.1	<10	2	<1	<1.0	98	<6	5
DEC									
19...	--	--	--	--	--	--	--	--	--
MAR									
08...	<1	<0.1	<10	3	<1	<1.0	110	<6	4
MAY									
16...	4	<0.1	<10	1	<1	<1.0	100	<6	4
JUN									
27...	<1	--	<10	2	<1	<1.0	98	<6	8
SEP									
22...	<1	<0.1	<10	1	<1	<1.0	110	<6	21

04159500 BLACK RIVER NEAR FARGO, MI

LOCATION.--Lat 43°05'32", long 82°37'05", in NW1/4 sec.32, T.8 N., R.16 E., St. Clair County, Hydrologic Unit 04090001, on left bank 20 ft downstream from bridge on Norman Road, 2.1 mi east of Fargo, 5.3 mi upstream from Mill Creek, and 12 mi northwest of Port Huron.

DRAINAGE AREA.--480 mi^2.

PERIOD OF RECORD.--February 1944 to current year.

REVISED RECORDS.--WSP 1307: 1950(M). WSP 1627: 1956-58. WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 613.75 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to July 9, 1954, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 9-13, 16-18, 26, Dec. 29 to Mar. 14, Mar. 19-21, and June 17, 20, 21, 23-29. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--45 years, 296 ft^3/s, 8.37 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 14,400 ft^3/s, Apr. 5, 1947, gage height, 16.06 ft, from floodmark, from rating curve extended above 9,500 ft^3/s; maximum gage height observed, 18.05 ft, Feb. 20, 1951, backwater from ice; minimum discharge observed, 1.8 ft^3/s, Sept. 18, 19, 1946.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 1400 ft^3/s, June 24, no peak discharge above base discharge of 3,500 ft^3/s; maximum gage height, 9.61 ft, Jan. 9, backwater from ice; minimum discharge, 13 ft^3/s, Oct. 1, Sept. 1; minimum gage height, 1.73 ft, Sept. 1.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	15	28	100	90	230	20	408	68	410	112	24	16
2	21	26	93	80	150	20	321	63	378	91	22	28
3	32	25	86	70	125	20	373	61	280	77	22	24
4	28	24	82	60	100	20	771	57	215	67	22	22
5	31	41	75	55	85	21	1270	56	188	60	24	18
6	28	175	71	57	70	21	807	56	163	54	24	17
7	25	423	68	58	60	22	505	58	128	50	22	23
8	24	307	66	250	52	23	395	57	105	45	22	21
9	22	211	63	800	46	24	327	58	100	40	23	23
10	21	294	60	500	42	30	267	58	182	38	22	28
11	20	1200	57	300	39	45	222	53	360	35	21	29
12	18	812	54	200	36	100	198	59	302	33	21	29
13	17	461	51	160	33	120	205	71	199	31	20	28
14	19	476	47	130	31	120	213	86	147	38	19	28
15	20	394	46	110	30	438	204	85	119	41	20	25
16	20	287	44	100	29	1050	205	75	141	36	22	25
17	20	232	43	93	28	371	188	66	1120	30	22	38
18	20	214	42	87	27	199	163	59	667	26	21	38
19	18	175	44	83	26	120	158	56	421	25	21	32
20	18	149	53	80	25	110	140	55	1170	35	23	42
21	25	156	55	78	24	100	122	56	1160	41	21	42
22	30	205	52	76	24	92	110	59	581	34	22	36
23	42	191	57	74	23	93	100	67	1220	30	27	33
24	33	159	53	73	23	205	90	62	1400	29	38	28
25	30	138	61	72	22	1030	83	61	1000	28	39	23
26	30	123	60	75	21	1140	80	68	660	27	36	20
27	43	113	57	85	21	675	78	67	420	27	34	19
28	44	116	148	110	20	545	79	65	280	26	30	20
29	38	126	200	120	---	1060	75	58	180	25	31	18
30	33	113	160	125	---	1040	71	55	140	24	25	18
31	31	---	120	200	---	576	---	108	---	24	17	---
TOTAL	816	7394	2268	4451	1442	9450	8228	1983	13836	1279	757	791
MEAN	26.3	246	73.2	144	51.5	305	274	64.0	461	41.3	24.4	26.4
MAX	44	1200	200	800	230	1140	1270	108	1400	112	39	42
MIN	15	24	42	55	20	20	71	53	100	24	17	16
CFSM	.06	.51	.15	.30	.11	.64	.57	.13	.96	.09	.05	.06
IN.	.06	.57	.18	.34	.11	.73	.64	.15	1.07	.10	.06	.06

CAL YR 1988 TOTAL 53742.5 MEAN 147 MAX 3500 MIN 9.5 CFSM .31 IN 4.17
WTR YR 1989 TOTAL 52695.0 MEAN 144 MAX 1400 MIN 15 CFSM .30 IN 4.08

04159900 MILL CREEK NEAR AVOCA, MI

LOCATION.--Lat 43°03'16", long 82°44'05", in NW1/4 sec.8, T.7 N., R.15 E., St. Clair County, Hydrologic Unit 04090001, on left bank at downstream side of bridge on Bricker Road, 0.2 mi upstream from Gleason Drain, and 2.3 mi west of Avoca.

DRAINAGE AREA.--169 mi^2.

PERIOD OF RECORD.--April 1963 to September 1975, October 1975 to September 1979 (operated as a crest-stage partial-record station), October 1987 to current year. Also operated as a low-flow partial-record station in water year 1979.

GAGE.--Water-stage recorder. Datum of gage is 711.31 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Oct. 1-18, Oct. 21 to Nov. 28, Dec. 2 to Mar. 22, and Apr. 5-11. Records fair, except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--14 years (water years 1964-75, 1988-89), 91.8 ft^3/s, 7.38 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,570 ft^3/s, Apr. 19, 1975, gage height, 8.87 ft; minimum, 0.8 ft^3/s, Aug. 9, 10, 11, 1964; minimum gage height, 0.56 ft, July 28, 1965.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 655 ft^3/s, June 23, gage height, 5.00 ft, no peak discharge above base discharge of 900 ft^3/s; minimum daily, 9.0 ft^3/s, Sept. 30; minimum gage height, 0.83 ft, Aug. 9, 10.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	10	14	24	32	42	12	108	26	441	61	16	15
2	11	14	23	27	40	12	89	23	477	50	14	15
3	13	15	22	23	36	12	112	21	341	43	13	13
4	16	16	21	20	32	13	203	20	257	38	12	12
5	15	22	20	18	28	18	265	20	193	32	12	13
6	14	35	20	17	24	28	200	19	155	28	12	12
7	13	45	19	90	22	23	140	22	123	25	13	12
8	12	42	18	250	20	18	100	21	95	23	12	12
9	12	40	18	220	19	16	85	19	155	21	10	18
10	12	65	17	180	18	17	70	18	405	19	9.1	31
11	12	100	17	127	17	20	71	16	362	16	10	51
12	13	80	17	92	16	22	71	17	257	15	11	37
13	15	70	16	80	15	26	73	20	196	13	18	28
14	14	64	16	70	15	35	74	28	164	13	15	23
15	13	56	16	60	16	60	69	31	143	12	14	19
16	13	45	16	50	16	100	62	27	186	11	16	19
17	13	40	15	40	16	55	57	23	364	10	37	27
18	13	35	15	30	15	47	52	20	277	9.6	40	22
19	13	30	15	27	14	46	49	18	307	9.2	26	25
20	12	35	16	23	14	45	44	19	507	12	19	21
21	13	47	17	22	14	45	40	21	477	16	15	18
22	14	45	19	22	14	45	39	30	438	16	14	16
23	15	40	20	21	14	46	34	23	586	19	13	14
24	17	35	21	21	14	71	32	20	369	47	13	13
25	18	32	26	20	13	126	33	25	262	40	16	12
26	19	30	27	24	13	141	32	23	203	26	15	11
27	18	28	30	28	13	122	32	26	164	26	13	9.9
28	17	26	75	32	13	123	31	22	131	27	12	9.5
29	16	24	80	35	---	166	31	18	103	30	12	9.2
30	15	23	60	38	---	174	30	21	77	23	12	9.0
31	14	---	45	43	---	134	---	112	---	19	11	---
TOTAL	435	1193	781	1782	543	1818	2328	769	8215	749.8	475.1	546.6
MEAN	14.0	39.8	25.2	57.5	19.4	58.6	77.6	24.8	274	24.2	15.3	18.2
MAX	19	100	80	250	42	174	265	112	586	61	40	51
MIN	10	14	15	17	13	12	30	16	77	9.2	9.1	9.0
CFSM	.08	.24	.15	.34	.12	.35	.46	.15	1.62	.14	.09	.11
IN.	.10	.26	.17	.39	.12	.40	.51	.17	1.81	.17	.10	.12

CAL YR 1988 TOTAL 20613.0 MEAN 56.3 MAX 900 MIN 1.4 CFSM .33 IN 4.54
WTR YR 1989 TOTAL 19635.5 MEAN 53.8 MAX 586 MIN 9.0 CFSM .32 IN 4.32

04160570 NORTH BRANCH BELLE RIVER AT IMLAY CITY, MI

LOCATION.--Lat 43°01'49", long 83°04'02", in SW1/4 NW1/4 sec.16, T.7 N., R.12 E., Lapeer County, Hydrologic Unit 04090001, on left bank 12 ft upstream from bridge on State Highway 21, 0.6 mi northeast of Imlay City.

DRAINAGE AREA.--18.0 mi².

PERIOD OF RECORD.--August 1965 to current year.

GAGE.--Water-stage recorder. Concrete control Aug. 20, 1965, to Nov. 2, 1981. Datum of gage is 789.69 ft above National Geodetic Vertical Datum of 1929 (levels by Boldt, McLeod, and Johnson, Inc.). Prior to Feb. 24, 1985, at datum 2.00 ft higher.

REMARKS.--Estimated daily discharges: Nov. 6-9, Nov. 29 to Dec. 3, Dec. 8 to Jan. 23, Feb. 3 to Mar. 10, May 22-30, June 2-9, and June 30 to July 20. Records poor. Some diversion by pumping for sprinkler irrigation. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--24 years, 12.0 ft³/s, 9.05 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 354 ft³/s, June 12, 1986, gage height, 6.66 ft, from rating curve extended above 100 ft³/s; maximum gage height, 9.33 ft, Apr. 19, 1975, datum then in use; no flow part of each day June 27, 28, 1977, June 26-28, 1979, June 30, 1988, caused by irrigation pumpage.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 60 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
June 1	0200	79	3.91	June 22	0300	*116	*5.04

Minimum daily discharge, 1.0 ft³/s, Oct. 1.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.0	3.3	5.2	5.6	11	2.9	11	4.7	69	6.0	2.8	3.7
2	3.2	3.3	5.7	5.0	10	3.0	9.8	4.7	50	5.5	2.7	4.1
3	3.6	3.6	6.0	4.8	9.0	3.5	17	4.7	37	5.0	2.5	2.9
4	3.1	4.1	5.2	4.5	7.6	5.0	29	4.4	27	4.5	2.9	2.4
5	2.7	8.5	4.7	4.7	6.8	7.0	26	4.4	20	4.2	3.2	2.3
6	2.3	12	5.2	4.9	6.0	5.5	16	4.9	15	3.9	1.8	12
7	2.0	11	4.7	5.0	5.2	4.3	13	4.4	12	3.7	1.7	20
8	1.7	10	4.5	45	4.7	3.9	11	4.3	10	3.4	2.0	11
9	1.5	9.0	4.4	25	4.3	4.2	9.8	4.1	25	3.2	1.8	42
10	2.0	27	4.3	15	4.1	4.5	8.6	3.8	39	3.0	1.5	19
11	3.0	20	4.1	7.7	3.9	5.0	7.7	3.5	28	2.8	3.7	12
12	2.9	14	3.9	6.6	3.8	5.8	7.6	4.6	20	2.7	4.1	9.0
13	2.7	14	3.8	6.0	3.6	7.5	8.5	7.6	20	2.5	1.5	6.7
14	2.8	12	3.6	5.6	3.5	6.2	7.9	6.2	19	2.7	1.4	7.2
15	2.6	9.7	3.5	5.4	3.3	14	8.3	5.6	19	2.8	3.1	6.2
16	4.0	8.5	3.4	5.2	3.2	10	7.7	5.1	25	2.5	7.0	6.2
17	12	7.5	3.3	5.1	3.1	7.5	7.9	5.1	28	2.4	3.5	10
18	12	6.4	3.2	5.1	3.0	8.6	8.1	4.7	24	2.3	2.5	7.6
19	8.2	5.8	3.5	5.1	3.0	11	7.3	3.7	29	2.2	2.3	6.7
20	4.3	6.4	3.8	5.1	3.0	9.3	6.8	3.9	50	8.0	2.3	5.8
21	3.3	8.6	4.1	5.0	2.9	9.5	6.6	3.8	73	9.5	2.3	5.5
22	3.1	8.5	4.5	5.0	2.9	8.1	5.9	3.5	108	4.2	3.2	5.0
23	3.7	7.1	4.8	5.0	2.9	7.3	5.4	3.2	72	3.8	4.8	4.6
24	4.6	6.0	4.9	5.0	2.9	12	5.2	3.0	49	3.6	5.0	4.4
25	5.0	5.4	5.0	5.4	2.9	14	5.2	3.3	36	3.5	3.3	4.0
26	5.1	5.2	5.0	7.8	2.9	15	5.2	3.6	27	3.1	2.8	3.9
27	4.7	5.4	8.5	8.8	2.9	14	5.4	3.1	18	3.2	2.6	3.7
28	4.1	5.6	14	8.9	2.9	18	5.5	2.9	13	2.6	2.3	3.6
29	3.6	5.2	12	7.2	---	21	5.5	2.6	8.4	2.5	2.7	3.5
30	3.4	5.2	9.0	9.5	---	16	5.2	5.0	7.0	2.3	2.7	3.5
31	3.3	---	7.0	9.9	---	13	---	37	---	2.7	3.2	---
TOTAL	121.5	258.3	164.8	253.9	125.3	276.6	284.1	165.4	977.4	114.3	89.2	238.5
MEAN	3.92	8.61	5.32	8.19	4.48	8.92	9.47	5.34	32.6	3.69	2.88	7.95
MAX	12	27	14	45	11	21	29	37	108	9.5	7.0	42
MIN	1.0	3.3	3.2	4.5	2.9	2.9	5.2	2.6	7.0	2.2	1.4	2.3
CFSM	.22	.48	.30	.46	.25	.50	.53	.30	1.81	.21	.16	.44
IN.	.25	.53	.34	.52	.26	.57	.59	.34	2.02	.24	.18	.49

CAL YR 1988 TOTAL 2833.82 MEAN 7.74 MAX 68 MIN .49 CFSM .43 IN 5.86
WTR YR 1989 TOTAL 3069.30 MEAN 8.41 MAX 108 MIN 1.0 CFSM .47 IN 6.34

04160600 BELLE RIVER AT MEMPHIS, MI

LOCATION.--Lat 42°54'03", long 82°46'09", in NW1/4 SE1/4 sec.35, T.6 N., R.14 E., St. Clair County, Hydrologic Unit 04090001, on right downstream side of bridge on State Highway 19 at Memphis.

DRAINAGE AREA.--151 mi^2.

PERIOD OF RECORD.--October 1962 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 705.41 ft above National Geodetic Vertical Datum of 1929 (Michigan Department of Transportation bench mark).

REMARKS.--Estimated daily discharges: Dec. 11, 12, Jan. 5, 9-16, 20-22, Feb. 2-13, 17, 22, 23, Feb. 28 to Mar. 2, Mar. 6-8, 18, 19, and Aug. 17 to Sept. 20. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--27 years, 90.5 ft^3/s, 8.14 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,520 ft^3/s, Apr. 19, 1975, gage height, 8.96 ft; minimum, 2.3 ft^3/s, Sept. 6, 10, 1978; minimum gage height, 1.17 ft, Sept. 6, 1978.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of April 1947, reached a stage of about 9 ft, from information by local residents.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 600 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
June 9	2030	*1,460	*a6.85	No other peak greater than base discharge.			

a From graph based on gage readings.

Minimum daily discharge, 9.7 ft^3/s, Oct. 1.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	9.7	17	27	42	60	18	98	25	145	53	17	26
2	13	17	26	32	58	17	79	24	260	39	15	28
3	16	17	26	32	53	17	113	23	177	35	14	21
4	19	18	28	25	46	18	269	22	169	31	15	18
5	17	23	24	26	41	25	307	21	166	28	16	16
6	15	41	23	27	35	40	216	21	102	27	17	25
7	15	53	23	28	31	30	147	22	70	25	16	100
8	13	49	25	260	28	25	112	21	51	23	14	120
9	13	43	24	235	26	22	93	19	328	21	13	200
10	14	68	21	160	24	22	75	19	682	20	13	330
11	13	124	21	95	23	25	65	18	400	18	14	250
12	15	88	21	80	22	31	59	19	240	16	13	130
13	17	79	21	70	21	38	60	22	149	15	19	70
14	16	86	21	60	22	34	61	30	110	14	16	55
15	15	69	21	50	22	43	59	29	88	14	15	45
16	14	54	19	40	22	77	56	26	113	14	21	50
17	14	47	19	35	22	54	52	24	174	16	30	80
18	21	41	19	30	22	120	52	22	133	16	23	100
19	29	36	18	30	18	160	53	21	104	15	20	80
20	26	35	19	30	19	155	48	22	225	23	18	49
21	22	54	21	30	19	113	44	22	340	38	17	39
22	19	54	22	30	20	82	41	21	406	56	23	33
23	18	47	24	29	20	66	39	20	513	45	30	31
24	19	41	27	27	20	86	35	18	337	35	35	28
25	20	37	28	27	18	109	31	17	206	33	26	23
26	21	34	27	33	18	114	30	18	133	27	20	22
27	21	32	28	50	18	109	27	20	104	24	18	21
28	19	31	90	53	18	118	26	18	102	25	16	20
29	19	29	98	37	---	192	26	16	90	21	18	19
30	17	27	71	51	---	197	26	17	69	19	21	19
31	17	---	53	60	---	135	---	22	---	19	24	---
TOTAL	536.7	1391	935	1814	766	2292	2399	659	6186	805	587	2048
MEAN	17.3	46.4	30.2	58.5	27.4	73.9	80.0	21.3	206	26.0	18.9	68.3
MAX	29	124	98	260	60	197	307	30	682	56	35	330
MIN	9.7	17	18	25	18	17	26	16	51	14	13	16
CFSM	.12	.31	.20	.39	.18	.49	.53	.14	1.36	.17	.13	.45
IN.	.13	.34	.23	.45	.19	.56	.59	.16	1.52	.20	.14	.50

CAL YR 1988 TOTAL 19699.9 MEAN 53.8 MAX 789 MIN 3.5 CFSM .36 IN 4.85
WTR YR 1989 TOTAL 20418.7 MEAN 55.9 MAX 682 MIN 9.7 CFSM .37 IN 5.03

04160800 SASHABAW CREEK NEAR DRAYTON PLAINS, MI

LOCATION.--Lat 42°43'12", long 83°21'13", in SE1/4 sec.26, T.4 N., R.9 E., Oakland County, Hydrologic Unit 04090003, on right bank at upstream side of culverts on Maybee Road, 1.1 mi upstream from mouth, and 2.5 mi northeast of Drayton Plains.

DRAINAGE AREA.--20.9 mi².

PERIOD OF RECORD.--October 1959 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Metal V-notch weir Aug. 30, 1961, to Mar. 6, 1968. Elevation of gage is 970 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 26, 29, 30, Jan. 4, 11-14, 21, Feb. 3-19, 23, and Mar. 1, 2, 5-9, 19. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--30 years, 12.7 ft³/s, 8.25 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 181 ft³/s, Oct. 1, 1981, gage height, 4.53 ft; minimum, 0.03 ft³/s, July 9, 16, 1988; minimum gage height, 1.59 ft, Aug. 1, 2, 1960.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 55 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
June 27	1600	60	3.54	Sept. 9	0900	*74	*3.81

Minimum daily discharge, 2.8 ft³/s, Oct. 15.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.2	6.4	18	13	16	5.6	26	12	31	29	9.0	15
2	5.8	6.5	17	12	14	5.5	23	12	27	26	7.4	18
3	6.3	6.2	16	12	13	5.5	32	11	22	24	6.2	13
4	4.8	6.7	15	12	10	5.6	40	11	22	22	5.8	11
5	4.0	13	15	12	9.5	7.5	39	11	20	21	6.0	9.8
6	3.6	24	14	12	9.0	6.5	34	11	17	22	5.4	18
7	3.5	21	14	12	8.7	6.0	30	9.9	14	18	4.8	38
8	3.3	21	13	36	8.4	5.7	26	9.3	14	16	4.2	33
9	3.3	20	13	30	8.1	5.3	24	8.8	14	14	4.2	65
10	3.3	38	13	19	7.9	5.5	22	8.6	19	14	4.1	48
11	3.4	37	13	14	7.8	6.5	20	8.1	17	13	3.7	40
12	3.2	31	6.3	13	7.7	7.2	20	9.1	16	11	3.6	35
13	3.1	36	15	13	7.6	7.1	21	13	17	11	3.5	31
14	2.9	33	11	13	7.4	7.7	19	12	16	11	3.2	33
15	2.8	30	10	12	7.2	17	20	11	15	11	3.6	29
16	2.9	30	8.8	12	7.0	14	18	9.9	15	9.9	3.7	27
17	4.6	28	8.4	12	6.8	15	19	9.2	14	8.7	3.4	30
18	11	24	8.1	12	6.4	37	20	7.7	13	7.7	3.2	26
19	9.5	22	8.4	12	6.2	28	18	8.3	15	7.2	3.3	23
20	7.3	24	9.6	12	6.2	25	17	9.3	27	12	5.0	21
21	6.8	30	9.9	11	6.4	22	17	9.1	30	17	4.5	19
22	7.2	26	9.3	11	6.2	19	16	5.0	46	14	16	18
23	8.1	24	14	9.9	6.2	18	15	5.9	41	11	21	17
24	10	23	14	9.8	6.2	19	14	6.4	33	9.4	12	15
25	11	21	13	9.6	6.1	22	14	8.7	28	7.4	9.7	14
26	10	21	12	12	5.9	24	13	11	29	6.3	8.0	13
27	8.8	21	13	12	5.6	25	13	9.7	55	9.2	7.0	12
28	8.1	20	20	12	5.6	32	13	8.8	53	33	7.0	11
29	7.2	19	19	12	---	41	13	8.3	42	18	9.7	11
30	6.6	18	16	15	---	35	12	9.8	34	13	9.5	9.9
31	6.2	---	14	15	---	31	---	20	---	11	8.2	---
TOTAL	181.8	680.8	400.8	424.3	223.1	511.2	628	304.9	756	457.8	205.9	703.7
MEAN	5.86	22.7	12.9	13.7	7.97	16.5	20.9	9.84	25.2	14.8	6.64	23.5
MAX	11	38	20	36	16	41	40	20	55	33	21	65
MIN	2.8	6.2	6.3	9.6	5.6	5.3	12	5.0	13	6.3	3.2	9.8
CFSM	.28	1.09	.62	.66	.38	.79	1.00	.47	1.21	.71	.32	1.12
IN.	.32	1.21	.71	.76	.40	.91	1.12	.54	1.35	.81	.37	1.25

CAL YR 1988 TOTAL 4123.35 MEAN 11.3 MAX 45 MIN .04 CFSM .54 IN 7.34
WTR YR 1989 TOTAL 5478.30 MEAN 15.0 MAX 65 MIN 2.8 CFSM .72 IN 9.75

STREAMS TRIBUTARY TO LAKE ST. CLAIR

04160900 CLINTON RIVER NEAR DRAYTON PLAINS, MI

LOCATION.--Lat 42°39'37", long 83°23'25", in NE1/4 sec.21, T.3 N., R.9 E., Oakland County, Hydrologic Unit 04090003, on left bank at downstream side of bridge on State Highway 59, 1.0 mi downstream from State fish hatchery, and 2.0 mi south of Drayton Plains.

DRAINAGE AREA.--79.2 mi².

PERIOD OF RECORD.--October 1959 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 940 ft above National Geodetic Vertical Datum of 1929, from topographic map. Jan. 29 to July 9, 1964, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Jan. 7, and Jan. 10 to Feb. 9. Records good except for estimated daily discharges, which are fair. Some regulation and occasional diversion for lake-level control at many lakes upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--30 years, 50.8 ft³/s, 8.71 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 276 ft³/s, Mar. 12, 1974, gage height, 4.95 ft; minimum, 2.4 ft³/s, May 31, 1961; minimum gage height, 1.23 ft, Jan. 4, 1961.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 149 ft³/s, June 9, gage height, 4.01 ft; minimum, 8.2 ft³/s, Aug. 13, 14, 16, 17, 18, 19, 21, gage height, 2.13 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	31	50	76	53	58	38	59	14	70	127	70	60
2	37	54	70	52	59	38	60	15	85	122	67	59
3	34	62	67	52	59	38	65	14	86	118	61	58
4	35	65	64	52	57	39	60	15	87	112	48	56
5	33	75	62	52	55	39	51	14	83	102	32	32
6	31	75	59	52	52	38	58	12	79	87	43	57
7	29	73	58	57	50	40	70	12	75	77	42	116
8	28	73	56	61	48	38	90	14	73	55	41	122
9	28	72	57	58	47	37	90	14	89	32	36	128
10	28	87	57	57	46	37	89	14	106	31	17	138
11	29	90	57	56	45	37	88	17	110	31	9.2	142
12	27	90	56	55	45	37	91	24	103	30	8.8	139
13	24	97	55	54	44	37	90	38	95	28	8.5	134
14	24	100	54	54	43	38	87	38	90	25	8.6	131
15	28	103	52	53	42	41	88	38	74	20	8.9	124
16	33	104	51	52	42	40	84	37	62	19	8.5	119
17	33	103	50	52	42	44	81	37	62	17	8.5	116
18	40	104	50	51	42	57	74	37	60	16	8.4	110
19	51	103	49	50	42	54	63	35	59	14	8.4	106
20	52	105	47	50	42	55	62	38	62	21	8.9	103
21	56	106	47	50	42	55	59	37	92	25	8.5	100
22	63	103	46	49	42	55	51	34	123	37	30	98
23	64	102	50	49	41	56	47	32	115	37	63	89
24	65	100	49	49	40	56	38	28	118	35	65	65
25	65	98	48	49	40	57	27	33	130	33	65	50
26	62	96	48	50	39	58	22	31	121	32	63	37
27	59	92	53	51	39	54	15	30	130	34	61	27
28	57	90	54	52	38	50	12	30	127	40	60	15
29	54	85	53	53	---	52	13	30	132	46	61	15
30	53	79	53	55	---	55	13	34	133	55	59	18
31	51	---	53	57	---	57	---	53	---	71	56	---
TOTAL	1304	2636	1701	1637	1281	1427	1797	849	2834	1529	1135.2	2564
MEAN	42.1	87.9	54.9	52.8	45.8	46.0	59.9	27.4	94.5	49.3	36.6	85.5
MAX	65	106	76	61	59	58	91	53	133	127	70	142
MIN	24	50	46	49	38	37	12	12	59	14	8.4	15
CFSM	.53	1.11	.69	.67	.58	.58	.76	.35	1.19	.62	.46	1.08
IN.	.61	1.24	.80	.77	.60	.67	.84	.40	1.33	.72	.53	1.20

CAL YR 1988 TOTAL 15510.9 MEAN 42.4 MAX 122 MIN 5.2 CFSM .54 IN 7.29
WTR YR 1989 TOTAL 20694.2 MEAN 56.7 MAX 142 MIN 8.4 CFSM .72 IN 9.72

04161100 GALLOWAY CREEK NEAR AUBURN HEIGHTS, MI

LOCATION.--Lat 42°40'02", long 83°12'02", in SE1/4 sec.18, T.3 N., R.11 E., Oakland County, Hydrologic Unit 04090003, on right bank 12 ft downstream from wooden bridge on Oakland University property, and 2.7 mi northeast of Auburn Heights.

DRAINAGE AREA.--17.9 mi^2.

PERIOD OF RECORD.--October 1959 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder and concrete control. Datum of gage is 820.78 ft above National Geodetic Vertical Datum of 1929 (levels by Johnson and Anderson, Inc.).

REMARKS.--Estimated daily discharges: Dec. 12 and Feb. 4-9, 24, 25. Records good. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--30 years, 10.8 ft^3/s, 8.19 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 536 ft^3/s, Aug. 24, 1985, gage height, 5.62 ft· maximum gage height, 6.27 ft, June 25, 1968; minimum discharge, 0.01 ft^3/s, on many days during July and August, 1964; minimum gage height, 0.82 ft, Aug. 1, 1960.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 120 ft^3/s (revised) and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Jan. 8	0230	148	a4.55	Aug. 22	1600	258	4.98
Mar. 18	0300	180	4.70	Sept. 7	0500	168	4.55
June 21	1800	*390	*5.33				

a From graph based on gage readings.

Minimum discharge, 1.7 ft^3/s, Mar. 2, gage height, 1.47 ft, result of freezeup.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.0	4.9	8.6	7.7	14	3.1	15	6.6	49	15	8.6	25
2	23	4.9	7.8	6.9	12	3.0	13	6.3	29	11	6.7	19
3	14	4.4	7.7	6.3	9.2	3.0	42	6.1	20	9.3	5.4	10
4	7.9	8.1	7.0	5.7	7.0	6.7	46	5.6	19	7.8	5.7	6.6
5	5.5	46	6.6	5.4	5.8	11	36	7.5	12	6.8	6.6	5.2
6	4.4	61	6.6	5.4	5.0	6.0	27	6.7	9.0	6.1	5.0	41
7	3.9	40	6.5	13	4.6	5.9	22	6.2	7.3	5.4	4.0	106
8	3.5	32	6.1	87	4.3	3.9	18	5.5	10	4.7	3.5	65
9	4.2	23	5.6	37	4.1	3.5	16	5.3	27	4.0	3.3	74
10	7.0	81	5.3	21	4.0	3.9	13	5.1	58	3.7	2.7	61
11	6.8	51	4.7	15	3.9	5.3	11	4.8	42	3.4	7.7	38
12	5.3	27	4.6	17	3.9	6.5	14	7.3	30	3.1	8.9	26
13	4.1	52	4.6	13	3.9	5.9	14	14	24	3.0	4.0	19
14	3.6	32	4.4	9.4	6.2	7.3	12	9.4	24	2.8	3.2	18
15	3.4	21	4.3	8.1	5.7	16	14	7.8	50	2.7	4.4	15
16	4.7	19	3.9	7.2	5.2	11	12	6.8	39	2.6	3.8	20
17	14	16	3.7	6.8	4.6	14	17	6.1	24	2.4	3.2	25
18	55	12	3.5	7.0	4.2	111	19	5.5	16	2.2	2.8	16
19	22	11	3.6	7.5	4.2	57	14	5.5	36	3.4	2.6	11
20	12	33	4.8	7.5	3.9	39	11	9.7	49	70	4.7	9.3
21	8.4	44	5.2	5.9	5.0	28	12	7.5	154	38	3.8	8.1
22	9.2	25	4.6	5.9	5.0	19	11	5.9	126	20	73	7.4
23	11	18	25	5.7	4.0	15	9.3	5.2	66	13	67	6.3
24	16	14	14	5.8	3.9	14	8.6	4.6	40	9.1	32	5.4
25	21	12	9.8	6.3	3.8	15	8.5	19	27	6.8	18	5.1
26	12	11	6.8	23	3.6	16	8.8	22	22	5.2	11	4.8
27	8.0	13	24	14	3.4	18	8.4	11	61	14	8.3	4.5
28	6.9	11	49	10	3.2	23	7.7	6.9	46	63	7.4	4.5
29	5.5	9.3	22	11	---	28	7.3	5.3	30	30	11	4.3
30	4.9	8.7	13	15	---	24	6.9	11	20	17	7.1	4.0
31	4.7	---	9.3	14	---	19	---	65	---	12	5.5	---
TOTAL	314.9	745.3	292.6	410.5	147.6	542.0	474.5	301.2	1166.3	397.5	340.9	664.5
MEAN	10.2	24.8	9.44	13.2	5.27	17.5	15.8	9.72	38.9	12.8	11.0	22.2
MAX	55	81	49	87	14	111	46	65	154	70	73	106
MIN	3.0	4.4	3.5	5.4	3.2	3.0	6.9	4.6	7.3	2.2	2.6	4.0
CFSM	.57	1.39	.53	.74	.29	.98	.88	.54	2.17	.72	.62	1.24
IN.	.65	1.55	.61	.85	.31	1.13	.99	.63	2.42	.83	.71	1.38

CAL YR 1988 TOTAL 3923.98 MEAN 10.7 MAX 81 MIN .93 CFSM .60 IN 8.15
WTR YR 1989 TOTAL 5797.80 MEAN 15.9 MAX 154 MIN 2.2 CFSM .89 IN 12.05

04161500 PAINT CREEK NEAR LAKE ORION, MI

LOCATION.--Lat 42°46'03", long 83°13'12", in NE1/4 sec.13, T.4 N., R.10 E., Oakland County, Hydrologic Unit 04090003, on left bank 100 ft upstream from railroad bridge, 1.6 mi southeast of Lake Orion, and 2.8 mi upstream from Trout Creek.

DRAINAGE AREA.--38.5 mi^2.

PERIOD OF RECORD.--September 1955 to September 1975, October 1975 to September 1988 (operated as a crest-stage partial-record station), October 1988 to September 1989.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 929.80 ft above National Geodetic Vertical Datum of 1929 (levels by Giffels and Webster Engineering Inc.).

REMARKS.--Estimated daily discharges: Oct. 1-7, Dec. 11-14, 16, Jan. 10, 11, and Feb. 8, 9, 23, 24. Records good except for estimated daily discharges, which are fair. Occasional regulation by Lake Orion. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--21 years (water years 1956-75, 1989), 25.3 ft^3/s, 8.92 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 428 ft^3/s, Apr. 19, 1975, gage height, 4.26 ft, from floodmark; maximum gage height, 4.43 ft, Sept. 22, 1971, result of construction downstream; minimum discharge, 1.2 ft^3/s, June 28, July 13, 14, 15, 1959.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 90 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Dec. 12	1600	ice jam	*3.26	June 21	1600	101	2.87
June 19	1630	90	a2.79	Sept. 8	2115	*137	a3.10

a From graph based on gage readings.

Minimum discharge, 4.6 ft^3/s, Aug. 16, 17, 18, 19, minimum gage height, 1.57 ft, Aug. 17, 18, 19.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	15	6.4	52	24	22	14	40	13	49	37	15	16
2	20	6.9	40	24	22	13	40	13	58	32	11	15
3	19	7.8	15	23	22	13	44	13	53	30	10	13
4	17	9.5	17	23	22	15	48	11	52	27	6.8	11
5	16	15	19	22	22	15	49	9.9	53	27	6.0	10
6	15	15	29	22	22	14	50	8.6	45	24	8.1	14
7	14	17	29	25	21	14	50	8.7	47	20	8.8	19
8	12	23	27	32	20	14	48	8.9	39	14	7.9	32
9	12	27	25	29	19	14	47	9.3	44	14	6.9	45
10	12	50	24	34	18	14	45	9.7	40	16	7.6	38
11	12	44	21	34	17	14	41	9.5	34	16	6.2	32
12	10	46	16	33	16	13	40	12	33	14	5.3	28
13	9.6	54	13	31	16	13	39	15	35	12	5.6	24
14	22	57	10	30	17	14	37	15	34	9.3	5.6	22
15	30	54	10	30	16	17	37	16	33	8.5	5.2	19
16	28	51	10	28	15	16	36	16	33	8.1	4.9	19
17	31	50	11	27	15	19	36	16	29	6.0	4.7	18
18	35	45	11	25	14	34	35	15	27	5.9	4.6	16
19	39	44	11	24	14	30	34	14	36	6.5	4.9	14
20	38	47	11	24	14	31	32	16	44	16	8.3	14
21	37	49	11	22	15	31	30	16	71	19	9.6	13
22	37	48	11	21	15	29	28	14	81	22	19	12
23	38	48	16	20	15	28	27	14	81	20	24	11
24	38	43	15	20	15	28	22	14	69	17	18	9.6
25	35	39	15	19	14	27	15	18	59	14	14	9.2
26	32	38	15	22	14	27	16	21	53	12	13	8.9
27	29	39	24	20	14	28	17	20	54	14	11	8.5
28	29	38	26	20	14	32	14	15	49	16	9.7	8.4
29	28	54	25	21	---	36	13	12	42	14	13	10
30	27	60	25	22	---	39	14	15	41	13	12	14
31	16	---	25	21	---	40	---	33	---	13	9.5	---
TOTAL	752.6	1125.6	609	772	480	686	1024	441.6	1418	517.3	296.2	523.6
MEAN	24.3	37.5	19.6	24.9	17.1	22.1	34.1	14.2	47.3	16.7	9.55	17.5
MAX	39	60	52	34	22	40	50	33	81	37	24	45
MIN	9.6	6.4	10	19	14	13	13	8.6	27	5.9	4.6	8.4
CFSM	.63	.97	.51	.65	.44	.57	.89	.37	1.23	.43	.25	.46
IN.	.73	1.09	.59	.75	.46	.66	.99	.43	1.37	.50	.29	.51

WTR YR 1989 TOTAL 8645.9 MEAN 23.7 MAX 81 MIN 4.6 CFSM .62 IN 8.35

04161540 PAINT CREEK AT ROCHESTER, MI

LOCATION.--Lat 42°41'18", long 83°08'35", in NW1/4 SE1/4 sec.10, T.3 N., R.11 E., Oakland County, Hydrologic Unit 04090003, on right bank at upstream side of bridge on Ludlow Street in Rochester, and 1.5 mi upstream from mouth.

DRAINAGE AREA.--70.9 mi^2.

PERIOD OF RECORD.--October 1959 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 755.11 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 11-19, 30, 31, Jan. 4, 5, 9, 10, 14, 21, 22, Feb. 4-15, 17-19, 23-25, and Mar. 2, 3, 6-9. Records good except for estimated daily discharges, which are fair. Occasional regulation by Lake Orion. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--30 years, 52.1 ft^3/s, 9.98 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 918 ft^3/s, Feb. 1, 1968; maximum gage height, 5.95 ft, Feb. 10, 1965, backwater from ice; minimum discharge, 1.2 ft^3/s, Aug. 19, 1974, caused by regulation due to bridge construction; minimum gage height, 1.26 ft, Sept. 16, 1960.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 300 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Mar. 18	0400	318	3.42	June 26	2400	361	3.50
June 9	1700	390	3.59	Aug. 22	1215	*644	*4.25
June 16	0630	321	3.37	Sept. 6	1400	315	3.35
June 21	1700	493	3.88	Sept. 7	0300	336	3.42

Minimum daily discharge, 15 ft^3/s, Aug. 19.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	23	28	76	42	48	26	57	33	115	69	27	54
2	52	28	71	42	43	25	57	30	99	61	24	46
3	38	27	45	40	41	25	98	30	86	55	24	34
4	31	31	42	40	40	29	113	29	83	50	23	29
5	33	77	43	40	40	42	102	29	74	47	24	27
6	29	82	49	40	40	28	89	27	63	45	22	159
7	27	61	53	56	39	27	81	25	60	41	22	206
8	24	61	49	170	39	26	75	25	54	33	21	122
9	25	61	47	75	38	25	70	25	130	30	20	191
10	26	154	45	63	37	25	66	25	176	30	19	138
11	30	106	43	57	36	28	62	25	99	33	26	94
12	25	88	41	57	35	31	61	29	74	30	27	71
13	38	125	39	52	34	27	62	41	74	28	19	59
14	31	102	37	50	33	30	58	37	78	25	18	56
15	44	92	34	48	31	59	58	37	99	23	21	51
16	47	83	32	47	30	38	56	35	106	22	19	56
17	62	79	30	45	29	46	61	33	73	20	17	65
18	89	70	28	44	29	208	62	31	59	19	16	48
19	64	67	30	44	28	81	57	31	72	22	15	42
20	57	90	34	42	28	62	52	37	127	99	20	38
21	55	101	31	41	29	52	51	36	279	64	22	36
22	57	81	29	39	29	46	47	32	297	51	152	34
23	60	75	50	38	29	45	45	30	178	46	71	36
24	69	69	38	37	28	47	43	28	137	40	43	33
25	67	63	35	37	27	50	35	46	109	33	34	33
26	56	61	32	57	27	52	35	49	127	30	29	32
27	50	62	55	45	26	52	36	40	219	36	26	30
28	48	59	87	41	26	62	34	34	127	59	26	30
29	46	63	49	42	---	73	30	29	91	37	31	30
30	45	82	45	50	---	64	32	37	78	33	29	34
31	43	---	43	47	---	61	---	130	---	30	25	---
TOTAL	1391	2228	1362	1568	939	1492	1785	1105	3443	1241	912	1914
MEAN	44.9	74.3	43.9	50.6	33.5	48.1	59.5	35.6	115	40.0	29.4	63.8
MAX	89	154	87	170	48	208	113	130	297	99	152	206
MIN	23	27	28	37	26	25	30	25	54	19	15	27
CFSM	.63	1.05	.62	.71	.47	.68	.84	.50	1.62	.56	.42	.90
IN.	.73	1.17	.71	.82	.49	.78	.94	.58	1.81	.65	.48	1.00

CAL YR 1988 TOTAL 15385.0 MEAN 42.0 MAX 165 MIN 6.8 CFSM .59 IN 8.07
WTR YR 1989 TOTAL 19380.0 MEAN 53.1 MAX 297 MIN 15 CFSM .75 IN 10.17

04161580 STONY CREEK NEAR ROMEO, MI

LOCATION.--Lat 42°48'03", long 83°05'25", in SW1/4 sec.31, T.5 N., R.12 E., Macomb County, Hydrologic Unit 04090003, on right bank at upstream side of culvert on Romeo Road, and 4.0 mi west of Romeo.

DRAINAGE AREA.--25.6 mi².

PERIOD OF RECORD.--October 1964 to current year.

GAGE.--Water-stage recorder. Datum of gage is 861.64 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 12-18, 30, Jan. 4-14, and Feb. 3 to Mar. 23. Records fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--25 years, 17.4 ft³/s, 9.23 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 290 ft³/s, Apr. 19, 1975, gage height, 5.19 ft; minimum, 0.92 ft³/s, Oct. 5, 9, 1967; minimum gage height, 1.28 ft, July 27, 28, 1965.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 100 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
June 9	1830	*126	*a3.75	No other peak greater than base discharge.			

a From graph based on gage readings.

Minimum daily discharge, 3.0 ft³/s, Aug. 13, 14.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	11	10	17	12	21	6.5	19	10	38	36	3.6	6.7
2	16	11	16	12	17	6.4	17	8.8	37	28	3.4	6.3
3	16	10	16	11	14	6.3	29	8.3	39	17	3.5	4.0
4	14	9.7	9.2	11	12	6.8	38	7.1	46	12	4.1	3.5
5	13	16	7.8	10	11	7.5	36	7.9	41	15	5.2	3.5
6	11	23	7.6	10	10	8.5	29	8.2	34	9.0	5.7	7.1
7	9.9	17	7.6	11	9.7	8.0	23	7.7	29	6.9	4.8	21
8	9.1	20	7.3	35	9.3	7.0	20	7.1	28	6.1	4.2	29
9	9.0	19	13	22	8.6	6.9	19	6.5	49	5.3	3.7	46
10	9.3	30	13	17	8.0	6.8	17	6.4	66	4.9	4.5	39
11	9.4	35	12	15	7.8	7.0	16	6.0	46	4.4	4.6	32
12	7.8	32	11	15	7.6	7.6	16	7.8	36	4.0	3.6	28
13	5.8	37	10	14	7.7	8.5	17	13	34	4.0	3.0	24
14	5.5	34	9.8	13	8.0	9.5	15	9.9	31	3.9	3.0	21
15	6.1	31	9.6	13	8.2	20	18	8.8	27	4.5	3.5	19
16	6.0	28	9.2	12	8.1	12	24	7.9	31	3.9	4.9	18
17	8.7	25	8.9	12	8.0	12	28	7.2	25	3.6	4.5	22
18	18	22	8.6	12	7.5	30	29	6.3	20	3.3	3.2	14
19	17	22	10	12	7.2	18	26	6.2	30	3.6	3.8	10
20	14	24	11	12	7.3	16	23	8.2	47	15	3.4	9.2
21	13	24	12	11	7.7	15	23	8.4	66	16	3.4	17
22	13	18	10	11	7.8	14	21	6.8	89	8.9	4.9	21
23	13	15	15	10	7.6	13	19	5.7	96	6.5	5.6	10
24	15	16	13	10	7.0	17	17	5.2	91	5.3	5.1	5.2
25	16	17	12	9.7	6.6	21	16	9.7	75	4.5	5.9	5.1
26	14	19	10	14	6.7	22	16	11	63	3.8	4.9	11
27	13	19	15	12	6.8	23	15	8.0	64	4.7	5.0	10
28	12	18	22	11	6.6	32	14	6.3	60	6.7	3.8	9.4
29	11	16	17	13	---	37	14	5.1	48	4.8	4.8	9.1
30	10	17	15	18	---	29	13	7.8	44	4.2	3.9	8.0
31	9.9	---	13	17	---	23	---	26	---	3.9	3.5	---
TOTAL	356.5	634.7	368.6	417.7	254.8	457.3	627	259.3	1430	259.7	131.0	469.1
MEAN	11.5	21.2	11.9	13.5	9.10	14.8	20.9	8.36	47.7	8.38	4.23	15.6
MAX	18	37	22	35	21	37	38	26	96	36	5.9	46
MIN	5.5	9.7	7.3	9.7	6.6	6.3	13	5.1	20	3.3	3.0	3.5
CFSM	.45	.83	.47	.53	.36	.58	.82	.33	1.86	.33	.17	.61
IN.	.52	.92	.54	.61	.37	.66	.91	.38	2.08	.38	.19	.68

CAL YR 1988 TOTAL 4772.2 MEAN 13.0 MAX 57 MIN 1.3 CFSM .51 IN 6.93
WTR YR 1989 TOTAL 5665.7 MEAN 15.5 MAX 96 MIN 3.0 CFSM .61 IN 8.23

04161790 STONY LAKE NEAR WASHINGTON, MI

LOCATION.--Lat 42°42'58", long 83°05'58", in SE1/4 sec.31, T.4 N., R.12 E., Macomb County, Hydrologic Unit 04090003, on left bank 1,000 ft east of bridge over dam on Stony Creek, 2.7 mi west of Washington.

DRAINAGE AREA.--68.0 mi^2.

PERIOD OF RECORD.--February 1963 to current year.

REVISED RECORDS.--WDR MI-77-1: 1976.

GAGE.--Water-stage recorder. Datum of gage is 790.00 ft above National Geodetic Vertical Datum of 1929 (levels by Huron-Clinton Metropolitan Authority); gage readings have been converted to elevations NGVD.

REMARKS.--Reservoir is formed by an earthfill dam with concrete spillway completed in 1962. The spillway section includes a drum gate with minimum crest elevation of 796 ft, maximum of 802 ft; and 2 sluices, one on each side, with valve controls capable of draining lake. Total capacity (new capacity table put into use Oct. 1, 1973), 4,649 acre-ft at elevation of 802 ft. The reservoir began filling February 1963. Lake is used for recreational purposes.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents, 5,495 acre-ft, May 17, 18, 1974, Apr. 20, 1975, elevation, 803.6 ft; minimum recorded, 1,758 acre-ft, Nov. 21, 1967, elevation, 794.7 ft.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 5,171 acre-ft, June 21, elevation, 803.00 ft; minimum, 4,095 acre-ft, Mar. 1-4, elevation, 800.88 ft.

MONTHEND ELEVATION, IN FEET NGVD, AND CONTENTS AT 2400, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

Date	Elevation (feet)	Contents (acre-feet)	Change in contents	
			(acre-feet)	(equivalent in ft^3/s)
Sept. 30	801.70	4,499	--	--
Oct. 31	801.91	4,604	+105	+1.7
Nov. 30	802.02	4,659	+55	+0.9
Dec. 31	801.00	4,153	-506	-8.2
CAL YR 1988	--	--	-574	-0.8
Jan. 31	801.03	4,167	+14	+0.2
Feb. 28	800.89	4,100	-67	-1.2
Mar. 31	801.91	4,604	+504	+8.2
Apr. 30	802.09	4,696	+92	+1.5
May 31	802.27	4,789	+93	+1.5
June 30	802.53	4,925	+136	+2.3
July 31	802.14	4,722	-203	-3.3
Aug. 31	802.12	4,711	-11	-0.2
Sept. 30	802.17	4,737	+26	+0.4
WTR YR 1989	--	--	+238	+0.3

04161800 STONY CREEK NEAR WASHINGTON, MI

LOCATION.--Lat 42°42'55", long 83°05'31", in SW1/4 sec.31, T.4 N., R.12 E., Macomb County, Hydrologic Unit 04090003, on left bank at downstream side of bridge on Mt. Vernon Road, 500 ft downstream from Stony Lake Dam, and 2.9 mi west of Washington.

DRAINAGE AREA.--68.2 mi^2.

PERIOD OF RECORD.--July 1958 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 772.59 ft above National Geodetic Vertical Datum of 1929 (levels by Huron-Clinton Metropolitan Authority).

REMARKS.--Estimated daily discharges: Mar. 7-14. Records good. Occasional diurnal fluctuation caused by mills upstream from station prior to February 1963; occasional regulation by Stony Lake since (see preceding page). Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--31 years, 42.7 ft^3/s, 8.50 in/yr, adjusted for storage since 1963.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 552 ft^3/s, June 10, 1988, gage height, 6.44 ft, from rating curve extended above 380 ft^3/s, caused by momentary release of water from Stony Lake; maximum gage height, 6.71 ft, Mar. 6, 1959, backwater from ice; minimum discharge, 0.9 ft^3/s, July 10, 1963; minimum gage height, 1.79 ft, Apr. 6, 1979; minimum daily discharge, 1.3 ft^3/s, July 31, Aug. 2, 1964.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 212 ft^3/s, June 26, gage height, 4.40 ft; minimum, 9.0 ft^3/s, Aug. 9, 10, gage height, 2.11 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	22	24	38	35	46	18	65	33	62	95	17	24
2	35	25	36	33	44	17	61	28	74	82	15	30
3	34	23	37	31	40	18	73	26	76	69	14	26
4	31	25	33	30	35	19	85	24	77	56	14	21
5	29	36	30	28	32	23	94	25	77	46	17	17
6	24	49	27	29	32	23	68	25	74	40	17	50
7	23	53	26	29	30	20	50	24	69	36	13	109
8	22	54	24	61	27	19	53	21	62	29	10	100
9	23	52	23	68	24	19	59	22	84	24	9.3	122
10	23	74	23	62	23	19	56	28	133	20	9.5	130
11	23	75	23	55	22	20	52	23	139	17	14	107
12	21	73	22	48	21	22	51	17	127	13	24	84
13	18	85	23	43	22	23	52	22	109	14	22	70
14	16	86	46	37	23	25	48	26	98	11	18	62
15	16	82	42	36	23	35	50	28	107	12	18	55
16	16	75	56	34	23	42	47	27	123	12	17	54
17	20	67	42	32	22	46	52	24	119	12	16	62
18	24	61	30	31	20	96	56	23	98	11	13	56
19	17	55	44	30	20	93	56	22	90	12	12	49
20	23	62	40	31	20	55	55	25	114	38	13	43
21	28	66	71	28	23	40	54	26	150	52	13	38
22	31	61	54	27	22	48	52	26	195	53	27	38
23	31	55	47	27	20	42	45	24	203	46	40	36
24	36	49	41	28	18	42	41	21	196	42	32	30
25	37	45	37	27	18	49	40	28	178	34	24	26
26	35	42	32	34	19	54	41	37	167	28	20	24
27	32	42	35	36	19	38	39	34	191	25	17	23
28	31	42	42	35	18	49	36	29	158	30	16	23
29	28	40	44	35	---	58	33	27	131	23	18	23
30	26	38	41	38	---	66	32	26	111	21	17	23
31	24	---	38	41	---	71	---	39	---	19	15	---
TOTAL	799	1616	1147	1139	706	1209	1596	810	3592	1022	541.8	1555
MEAN	25.8	53.9	37.0	36.7	25.2	39.0	53.2	26.1	120	33.0	17.5	51.8
MAX	37	86	71	68	46	96	94	39	203	95	40	130
MIN	16	23	22	27	18	17	32	17	62	11	9.3	17
MEAN+	27.5	54.8	28.8	36.9	24.0	47.2	54.7	27.6	122	29.7	17.3	52.2
CFSM+	.40	.80	.42	.54	.35	.69	.80	.40	1.79	.44	.25	.77
IN.+	.46	.90	.49	.62	.37	.80	.89	.47	2.00	.50	.29	.85

CAL YR 1988 TOTAL 12160.3 MEAN 33.2 MAX 133 MIN 3.5 MEAN+ 32.4 CFSM+ .48 IN+ 6.47
WTR YR 1989 TOTAL 15732.8 MEAN 43.1 MAX 203 MIN 9.3 MEAN+ 43.4 CFSM+ .64 IN+ 8.64

+ Adjusted for change in contents in Stony Lake.

04163400 PLUM BROOK AT UTICA, MI

LOCATION.--Lat 42°36'05", long 83°04'27", in SE1/4 NE1/4 sec.7, T.2 N., R.12 E., Macomb County, Hydrologic Unit 04090003, on left bank at upstream side of bridge on Ryan Road, 1.0 mi southwest of Utica.

DRAINAGE AREA.--16.5 mi².

PERIOD OF RECORD.--July 1965 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 619.79 ft above National Geodetic Vertical Datum of 1929 (levels by Johnson and Anderson, Inc.).

REMARKS.--Estimated daily discharges: Dec. 14, 15, 21, 22, 25, 26, 29-31, Jan. 2-6, 9-21, Feb. 3 to Mar. 10, and Mar. 21, 22. Records good except for estimated daily discharges, which are fair. Occasional diversion for sprinkler irrigation. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--24 years, 13.3 ft³/s, 10.95 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,160 ft³/s, June 26, 1968, gage height, 10.36 ft; no flow part of each day July 19, 28, 1966, Aug. 22-28, Sept. 3, 11, 1969.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 200 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Jan. 8	0700	242	7.01	June 21	1900	*472	*8.80

Minimum daily discharge, 1.8 ft³/s, Aug. 9.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.8	5.2	9.1	7.4	12	2.4	11	5.2	31	7.7	9.1	15
2	23	6.5	8.2	7.0	9.3	2.3	9.0	5.8	17	6.6	5.8	17
3	16	5.4	6.9	6.0	6.0	2.3	46	5.4	13	5.8	4.4	6.1
4	7.9	7.0	5.9	5.5	4.5	3.5	55	4.4	17	5.4	3.2	3.7
5	4.3	38	6.8	5.0	3.9	8.0	37	5.3	11	5.9	4.0	5.4
6	4.2	54	6.9	4.5	3.5	4.0	26	6.0	8.6	5.3	4.1	15
7	4.1	28	6.0	12	3.4	3.0	21	5.0	5.9	4.7	3.3	89
8	2.9	24	5.9	133	3.3	2.9	16	6.1	9.7	3.3	2.5	45
9	4.9	22	5.0	35	3.2	2.7	14	4.6	36	3.2	1.8	77
10	4.9	91	3.9	22	3.1	3.0	14	4.0	45	4.2	2.9	46
11	8.1	32	4.1	14	3.0	3.6	12	4.3	14	3.6	3.4	25
12	6.2	16	2.7	9.5	3.0	4.7	13	4.4	10	2.5	7.4	19
13	4.6	42	3.0	8.5	3.0	4.3	19	13	15	3.2	4.2	12
14	2.9	22	4.5	7.5	4.5	4.8	13	8.1	12	2.3	2.6	11
15	2.8	15	4.4	6.5	3.7	14	14	6.0	12	2.1	6.5	10
16	3.0	17	3.2	6.0	3.3	8.6	12	6.1	67	2.2	11	11
17	15	17	2.4	5.5	3.2	7.5	17	4.9	30	3.1	4.6	30
18	80	11	2.1	5.6	3.1	109	24	5.0	15	2.0	2.5	14
19	15	9.2	3.1	5.8	3.1	34	15	4.2	45	3.3	1.9	9.6
20	8.6	33	4.4	6.0	3.0	20	14	8.0	72	79	3.6	6.7
21	9.4	64	5.5	5.0	3.2	18	12	7.3	193	32	4.7	5.4
22	8.4	24	4.0	4.1	4.0	15	10	5.7	157	18	49	4.9
23	7.7	16	26	3.9	3.1	13	8.7	4.0	51	30	42	4.1
24	20	13	15	4.1	2.9	11	9.4	3.2	31	15	9.6	3.4
25	17	12	11	4.2	2.8	12	8.2	14	18	11	5.6	3.2
26	11	11	7.0	23	2.7	13	8.2	29	15	7.6	3.7	3.1
27	7.8	12	22	12	2.6	15	7.4	9.4	51	9.0	3.0	2.8
28	6.8	12	63	8.5	2.5	19	7.3	4.7	28	32	2.8	2.7
29	5.2	9.4	20	8.8	---	23	6.6	3.5	14	10	26	2.6
30	4.2	9.2	11	14	---	18	5.8	7.6	11	7.0	11	2.6
31	4.0	---	9.0	12	---	14	---	59	---	6.4	4.2	---
TOTAL	322.7	677.9	292.0	411.9	108.9	415.6	485.6	263.2	1055.2	333.4	250.4	502.3
MEAN	10.4	22.6	9.42	13.3	3.89	13.4	16.2	8.49	35.2	10.8	8.08	16.7
MAX	80	91	63	133	12	109	55	59	193	79	49	89
MIN	2.8	5.2	2.1	3.9	2.5	2.3	5.8	3.2	5.9	2.0	1.8	2.6
CFSM	.63	1.37	.57	.81	.24	.81	.98	.52	2.13	.66	.49	1.01
IN.	.73	1.53	.66	.93	.25	.94	1.09	.59	2.38	.75	.56	1.13

CAL YR 1988 TOTAL 3497.48 MEAN 9.56 MAX 91 MIN .05 CFSM .58 IN 7.88
WTR YR 1989 TOTAL 5119.10 MEAN 14.0 MAX 193 MIN 1.8 CFSM .85 IN 11.54

04164000 CLINTON RIVER NEAR FRASER, MI

LOCATION.--Lat 42°34'40", long 82°57'00", in NW1/4 sec.20, T.2 N., R.13 E., Macomb County, Hydrologic Unit 04090003, on left bank 800 ft downstream from bridge on Garfield Road, 2.8 mi north of Fraser, and 4.0 mi upstream from North Branch.

DRAINAGE AREA.--444 mi^2.

PERIOD OF RECORD.--May 1947 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 577.71 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 17, 1949, nonrecording gage at site 800 ft upstream at same datum.

REMARKS.--Estimated daily discharges: Feb. 6-12. Records good. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--42 years, 381 ft^3/s, 11.65 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 8,840 ft^3/s, Oct. 1, 1981, gage height, 19.56 ft; minimum, 47 ft^3/s, Sept. 6, 1955; minimum gage height, 4.29 ft, Sept. 7, 1954.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Apr. 5 or 6, 1947, reached a stage of 20 ft, from floodmark, discharge, 9,000 ft^3/s.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 2,000 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Oct. 18	0400	2,660	14.14	July 20	1200	2,820	14.36
June 20	0100	2,020	13.03	Sept. 7	1100	2,080	13.17
June 22	2000	2,240	13.47	Sept. 9	0300	*3,590	*15.30

Minimum discharge, 128 ft^3/s, Aug. 19, gage height, 5.13 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	157	291	397	323	351	183	364	188	797	496	221	483
2	482	289	384	306	331	175	320	188	723	449	201	536
3	375	284	362	291	294	186	748	179	584	408	229	335
4	230	364	336	281	267	275	766	175	652	390	210	286
5	236	848	331	272	249	357	671	193	477	339	319	271
6	198	1100	318	279	235	219	509	187	442	306	183	718
7	186	642	315	327	225	188	409	164	418	323	189	1860
8	179	527	309	1270	215	182	372	160	507	339	191	1220
9	240	516	295	693	210	189	375	166	786	299	185	2500
10	216	1350	272	421	210	212	340	157	1290	249	187	1570
11	266	948	236	394	210	200	315	154	723	234	218	849
12	210	638	235	405	215	208	336	162	583	207	291	663
13	192	903	286	399	228	198	393	341	627	198	181	595
14	184	703	311	327	290	205	343	207	521	200	157	578
15	178	574	335	324	273	395	463	194	609	158	277	565
16	181	560	248	331	227	295	412	263	1360	143	430	552
17	388	524	272	311	207	264	492	248	831	140	173	784
18	1710	471	230	315	197	1430	670	231	601	143	143	505
19	475	438	239	300	195	921	490	237	683	227	132	437
20	327	777	292	291	206	524	446	327	1450	1940	199	411
21	331	1150	304	264	272	444	454	272	1050	1060	190	407
22	398	607	295	256	279	375	385	223	1900	454	595	420
23	370	495	645	270	204	359	349	214	1650	803	949	417
24	519	454	458	268	184	342	325	195	1030	419	416	395
25	450	424	362	257	199	342	322	452	815	370	296	302
26	381	414	275	529	200	352	273	498	665	329	241	289
27	341	442	560	385	201	368	233	306	1260	440	214	238
28	339	403	1130	326	188	473	220	257	957	844	213	235
29	319	391	497	316	---	529	203	194	687	379	495	230
30	296	394	372	353	---	424	195	242	562	253	306	230
31	293	---	344	349	---	401	---	1120	---	214	260	---
TOTAL	10647	17921	11245	11433	6562	11215	12193	8094	25240	12753	8491	18881
MEAN	343	597	363	369	234	362	406	261	841	411	274	629
MAX	1710	1350	1130	1270	351	1430	766	1120	1900	1940	949	2500
MIN	157	284	230	256	184	175	195	154	418	140	132	230
CFSM	.77	1.35	.82	.83	.53	.82	.91	.59	1.89	.93	.62	1.42
IN.	.89	1.50	.94	.96	.55	.94	1.02	.68	2.11	1.07	.71	1.58

CAL YR 1988 TOTAL 120751 MEAN 330 MAX 2050 MIN 81 CFSM .74 IN 10.12
WTR YR 1989 TOTAL 154675 MEAN 424 MAX 2500 MIN 132 CFSM .96 IN 12.96

04164100 EAST POND CREEK AT ROMEO, MI

LOCATION.--Lat 42°49'21", long 83°01'13", in NE1/4 SE1/4 sec.27, T.5 N., R.12 E., Macomb County, Hydrologic Unit 04090003, on right bank at upstream side of bridge on State Highway 53, and 1.4 mi north of Romeo.

DRAINAGE AREA.--21.8 mi².

PERIOD OF RECORD.--September 1958 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 780 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 26, 30, Jan. 3-5, 13, 14, 19-22, Feb. 4 to Mar. 13, and Mar. 20-25. Records good except for estimated daily discharges, which are fair. Occasional regulation by lakes upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--31 years, 16.2 ft³/s, 10.09 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 358 ft³/s, Feb. 10, 1965, gage height, 4.48 ft; maximum gage height, 4.56 ft, Mar. 12, 1962, backwater from ice; minimum discharge, 0.8 ft³/s, July 30, 31, 1964, Aug. 6, 7, 1965; minimum gage height, 0.71 ft, July 21, 1959.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 80 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
June 10	1000	*179	*3.25	June 22	0900	129	2.78
June 20	1100	115	2.64				

Minimum daily discharge, 3.6 ft³/s, Dec. 13.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.8	11	12	12	17	6.7	26	9.6	27	25	10	9.4
2	12	12	11	12	15	6.6	25	16	25	23	8.9	9.9
3	11	12	11	11	14	6.8	33	18	23	20	8.1	8.2
4	9.4	15	11	11	12	7.5	38	13	28	18	8.1	7.1
5	8.3	20	10	10	11	8.8	35	11	27	16	8.6	6.2
6	7.3	25	10	11	10	8.6	33	14	25	15	8.1	11
7	6.7	24	11	12	9.6	7.6	32	16	24	13	7.5	20
8	6.2	27	11	41	9.2	7.2	30	9.9	25	12	6.6	19
9	6.2	24	9.9	38	8.8	7.2	28	4.6	60	12	6.0	35
10	6.6	37	11	29	8.5	7.3	26	9.6	146	11	5.8	27
11	8.3	34	16	20	8.2	7.6	23	14	68	[illegible]	6.6	19
12	7.4	29	8.8	15	8.2	8.2	23	5.2	49	[illegible]	7.4	15
13	6.8	32	3.6	14	8.5	9.5	20	13	46	[illegible]	6.7	12
14	6.6	29	3.9	13	8.7	13	23	20	41	5.8	5.9	12
15	6.5	25	3.9	12	8.9	21	25	14	39	8.4	6.7	11
16	6.8	23	3.7	12	8.7	17	23	11	52	8.3	7.1	12
17	7.8	21	8.9	12	8.2	17	24	11	47	8.5	6.6	18
18	16	18	54	11	7.7	42	24	10	38	11	5.9	14
19	14	17	42	11	7.6	35	22	10	51	10	5.5	12
20	12	20	18	11	8.0	26	20	12	101	23	5.8	12
21	11	23	11	10	8.6	23	20	11	96	25	6.0	11
22	12	21	8.9	10	8.2	21	18	9.6	121	21	8.3	9.8
23	12	19	14	10	7.5	20	17	9.2	97	18	9.5	9.1
24	14	18	13	10	7.2	21	16	8.9	77	16	8.2	8.7
25	15	17	12	5.1	7.1	23	16	12	58	14	7.0	8.5
26	14	16	11	11	7.0	26	16	13	46	12	6.3	8.1
27	13	15	15	24	6.9	24	16	12	45	13	5.6	7.8
28	12	14	22	17	6.8	25	11	11	41	18	5.3	7.5
29	12	12	17	11	---	29	5.1	9.7	34	15	7.3	7.2
30	11	12	15	16	---	27	6.3	11	29	13	6.6	6.5
31	11	---	13	16	---	27	---	26	---	14	6.0	---
TOTAL	307.7	622	422.6	458.1	257.1	536.6	674.4	375.3	1586	449.1	218.0	374.0
MEAN	9.93	20.7	13.6	14.8	9.18	17.3	22.5	12.1	52.9	14.5	7.03	12.5
MAX	16	37	54	41	17	42	38	26	146	25	10	35
MIN	4.8	11	3.6	5.1	6.8	6.6	5.1	4.6	23	5.8	5.3	6.2
CFSM	.46	.95	.62	.68	.42	.79	1.03	.56	2.43	.67	.32	.57
IN.	.53	1.06	.72	.78	.44	.92	1.15	.64	2.71	.77	.37	.64

CAL YR 1988 TOTAL 4888.5 MEAN 13.4 MAX 61 MIN 1.5 CFSM .62 IN 8.34
WTR YR 1989 TOTAL 6280.9 MEAN 17.2 MAX 146 MIN 3.6 CFSM .79 IN 10.72

04164300 EAST BRANCH COON CREEK AT ARMADA, MI

LOCATION.--Lat 42°50'45", long 82°53'06", in NE1/4 sec.23, T.5 N., R.13 E., Macomb County, Hydrologic Unit 04090003, on right bank at downstream side of bridge on Prospect Street in Armada.

DRAINAGE AREA.--13.0 mi².

PERIOD OF RECORD.--October 1958 to current year.

REVISED RECORDS.--WDR MI-83: 1982.

GAGE.--Water-stage recorder and concrete control. Elevation of gage is 735 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Oct. 2, 5-8, 12-15, Feb. 5-11, Feb. 24 to Mar. 23, and Aug. 12, 13. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--31 years, 7.17 ft³/s, 7.49 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 910 ft³/s, Apr. 19, 1975, gage height, 6.69 ft; no flow Jan. 25 to Feb. 9, 1961, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 100 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Jan. 8	0800	214	3.74	June 9	2115	*452	*a5.15

a From graph based on gage readings.

Minimum daily discharge, 0.09 ft³/s, Oct. 3.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.12	.37	1.5	1.7	5.4	.42	6.0	1.2	6.6	2.4	.36	.56
2	.47	.38	1.3	1.4	3.3	.41	4.6	1.2	6.9	1.9	.30	.30
3	.09	.38	1.2	1.2	2.7	.41	20	1.3	5.4	1.4	.31	.17
4	.10	.65	1.1	1.1	1.8	.70	52	1.2	5.9	1.2	.40	.17
5	.11	2.8	1.1	1.1	1.2	2.0	37	1.2	7.2	1.2	.33	.17
6	.11	2.3	1.0	.94	.95	1.3	18	1.2	5.6	1.0	.23	.61
7	.11	2.4	.96	6.3	.85	1.0	11	1.2	3.6	.84	.23	1.2
8	.10	1.9	1.1	125	.76	.70	8.2	1.1	2.5	.66	.22	2.3
9	.38	1.7	.96	24	.74	.60	6.5	1.1	88	.48	.20	9.6
10	.47	12	.92	14	.72	.70	5.0	1.0	169	.44	.22	11
11	.21	13	.80	4.8	.70	1.0	4.2	.97	40	.41	.23	5.2
12	.18	5.8	.73	3.6	.68	1.4	4.1	1.1	23	.37	.21	2.5
13	.15	10	.68	3.1	.67	1.2	4.6	1.4	15	.33	.19	1.5
14	.12	11	.68	2.4	.74	1.5	4.1	1.4	9.6	.30	.17	1.1
15	.10	6.2	.64	1.7	.82	3.5	4.9	1.2	7.7	.33	.26	1.0
16	.11	4.8	.57	1.5	.82	2.3	4.0	1.2	21	.35	.31	1.3
17	.34	3.8	.57	1.4	.74	3.0	4.0	1.1	21	.35	.16	2.5
18	.69	2.7	.57	1.4	.64	33	4.4	1.0	11	.35	.16	2.1
19	.16	2.1	.57	1.5	.57	17	3.3	.94	31	.53	.17	1.5
20	.23	4.3	.79	1.6	.57	11	2.7	1.2	40	3.8	.19	1.2
21	.25	12	.73	1.4	.62	8.0	2.5	1.1	20	6.4	.17	1.0
22	.45	7.3	.69	1.1	.66	6.0	2.2	1.0	41	2.4	.41	.94
23	.63	4.8	1.7	1.1	.70	5.0	1.9	.87	28	1.4	.23	.92
24	.88	3.7	1.3	1.0	.60	7.0	1.7	.82	15	.93	.16	.80
25	.66	3.0	1.1	1.1	.47	11	1.5	1.3	8.2	.62	.16	.69
26	.47	2.6	.96	2.4	.46	13	1.5	1.3	5.7	.47	.17	.64
27	.40	2.5	3.9	3.1	.45	13	1.6	1.1	6.5	.61	.17	.57
28	.38	2.2	17	2.2	.43	16	1.6	.90	5.1	.90	.21	.60
29	.33	1.9	7.5	2.5	---	20	1.4	.79	4.2	.64	.31	.57
30	.30	1.6	4.4	6.3	---	14	1.3	1.0	3.2	.49	.20	.55
31	.30	---	2.5	5.3	---	8.5	---	5.0	---	.45	.22	---
TOTAL	9.40	130.18	59.52	227.24	29.76	204.64	225.8	38.39	656.9	33.95	7.26	53.26
MEAN	.30	4.34	1.92	7.33	1.06	6.60	7.53	1.24	21.9	1.10	.23	1.78
MAX	.88	13	17	125	5.4	33	52	5.0	169	6.4	.41	11
MIN	.09	.37	.57	.94	.43	.41	1.3	.79	2.5	.30	.16	.17
CFSM	.02	.33	.15	.56	.08	.51	.58	.10	1.69	.09	.02	.14
IN.	.03	.37	.17	.65	.09	.59	.65	.11	1.88	.10	.02	.15

CAL YR 1988 TOTAL 1389.39 MEAN 3.80 MAX 131 MIN .05 CFSM .29 IN 3.98
WTR YR 1989 TOTAL 1676.30 MEAN 4.59 MAX 169 MIN .09 CFSM .35 IN 4.80

04164500 NORTH BRANCH CLINTON RIVER NEAR MOUNT CLEMENS, MI

LOCATION.--Lat 42°37'45", long 82°53'25", in SW1/4 sec.35, T.3 N., R.13 E., Macomb County, Hydrologic Unit 04090003, on left bank 30 ft upstream from bridge on State Highway 59, 2 mi north of Mount Clemens, and 3.6 mi upstream from mouth.

DRAINAGE AREA.--199 mi^2.

PERIOD OF RECORD.--May 1947 to current year.

REVISED RECORDS.--WSP 1437: 1948. WSP 1557: Drainage area.

GAGE.--Water-stage recorder. Concrete control since September 1961. Datum of gage is 576.38 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Nov. 15, 1949, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 28-30 and Feb. 3-8. Records good. Some regulation at times by mill upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--42 years, 126 ft^3/s, 8.60 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,700 ft^3/s, Feb. 2, 1968, gage height, 18.62 ft; minimum, 0.08 ft^3/s, part of each day July 4-10, 14, 15, 1988; minimum gage height, 3.12 ft, Sept. 13, 14, 1954.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Apr. 5 or 6, 1947, reached a stage of 20.0 ft, from floodmark.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,200 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
June 21	0200	*1,820	*13.21	No other peak greater than base discharge.			

Minimum discharge, 8.8 ft^3/s, Oct. 1, gage height, 4.16 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	9.8	22	64	72	128	26	182	46	248	104	32	15
2	11	22	60	61	111	22	151	44	246	85	27	21
3	21	23	56	49	95	22	190	47	162	72	23	27
4	29	24	53	39	80	26	439	49	112	64	20	23
5	24	34	49	38	65	36	564	48	126	58	19	17
6	20	118	47	41	55	53	524	42	109	52	22	21
7	16	156	47	41	45	59	311	46	84	46	20	145
8	14	111	48	249	41	44	203	46	71	40	17	163
9	14	99	44	503	37	35	165	41	77	36	15	316
10	14	142	29	625	34	32	144	35	182	31	13	477
11	13	260	34	383	34	36	122	34	789	27	12	374
12	16	227	30	160	33	44	110	39	860	25	11	149
13	17	172	28	117	32	51	129	34	423	24	16	89
14	15	238	26	81	34	51	136	50	214	22	17	70
15	14	203	26	66	38	67	117	59	168	21	17	64
16	14	143	24	66	39	114	119	50	241	22	17	60
17	14	114	22	58	35	89	115	43	356	22	23	88
18	27	99	20	55	29	343	159	37	325	19	18	148
19	52	84	21	59	31	723	161	34	227	21	15	110
20	44	84	33	63	31	581	122	35	1050	52	14	73
21	32	224	38	51	30	287	100	42	1490	123	15	59
22	26	261	36	41	31	187	96	43	963	124	29	50
23	24	170	40	52	28	139	87	36	1000	87	51	40
24	25	120	56	49	23	122	76	30	731	60	35	37
25	29	100	63	50	27	137	69	33	409	44	26	33
26	33	89	47	65	26	172	66	55	209	38	20	31
27	34	84	44	112	27	195	63	60	697	34	16	29
28	29	84	130	103	27	237	60	45	715	78	14	27
29	25	77	200	85	---	308	57	34	298	70	15	25
30	25	68	150	92	---	330	49	29	142	50	16	24
31	24	---	90	137	---	247	---	62	---	38	16	---
TOTAL	704.8	3652	1655	3663	1246	4815	4886	1328	12724	1589	621	2805
MEAN	22.7	122	53.4	118	44.5	155	163	42.8	424	51.3	20.0	93.5
MAX	52	261	200	625	128	723	564	62	1490	124	51	477
MIN	9.8	22	20	38	23	22	49	29	71	19	11	15
CFSM	.11	.61	.27	.59	.22	.78	.82	.22	2.13	.26	.10	.47
IN.	.13	.68	.31	.68	.23	.90	.91	.25	2.38	.30	.12	.52

CAL YR 1988 TOTAL 29113.59 MEAN 79.5 MAX 939 MIN .09 CFSM .40 IN 5.44
WTR YR 1989 TOTAL 39688.80 MEAN 109 MAX 1490 MIN 9.8 CFSM .55 IN 7.42

04165500 CLINTON RIVER AT MOUNT CLEMENS, MI
(National stream quality accounting network station)

LOCATION.--Lat 42°35'45", long 82°54'35", Macomb County, Hydrologic Unit 04090003, on left bank at downstream side of bridge on Moravian Drive, 0.2 mi downstream from North Branch, and 0.5 mi west of Mount Clemens.

DRAINAGE AREA.--734 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--May 1934 to current year.

REVISED RECORDS.--WSP 1084: 1943, 1945-46. WSP 1937: 1935, 1936(M), 1937-39, 1949(M), 1950. WSP 1557: Drainage area. WSP 1727: 1952(M), 1954(M).

GAGE.--Water-stage recorder. Datum of gage is 570.43 ft above National Geodetic Vertical Datum of 1929. May 10, 1934, to Jan. 11, 1939, nonrecording gage at same site and datum. Auxiliary gage is a water-stage recorder on right bank 2.0 mi downstream from base gage at same datum. Mar. 15, 1938, to Jan. 3, 1952, auxiliary nonrecording gage 1.6 mi downstream from base gage at same datum.

REMARKS.--Estimated daily discharges: Oct. 30 to Nov. 3, Nov. 26 to Dec. 22, Dec. 26, Dec. 31 to Jan. 7, Jan. 14-25, 28, 29, Feb. 2 to Mar. 14, Mar. 16, 17, July 5-19, July 20 to Aug. 15, Aug. 17-21, Aug. 25 to Sept. 6 and Sept. 12-16, 18-30. Water-discharge records fair. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--55 years, 543 ft³/s, 10.05 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 21,200 ft³/s, Apr. 6, 1947, gage height, 23.55 ft, from floodmark; minimum not determined; minimum gage height, 2.72 ft, Nov. 29, 1963.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 3,000 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
June 22	1300	*4,230	*10.63	Sept. 9	0800	3,620	10.25
June 27	2000	3,320	9.54				

Minimum daily discharge, 170 ft³/s, Aug. 19.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	209	355	510	450	542	240	617	252	1360	719	290	580
2	548	350	500	410	500	230	522	252	1180	621	270	650
3	507	350	475	380	440	240	1200	244	834	543	290	450
4	299	423	450	365	400	350	1560	254	883	506	270	370
5	292	1030	425	360	360	450	1520	277	641	450	380	340
6	262	1560	410	380	330	310	1230	262	577	420	250	750
7	227	976	410	420	310	280	875	232	507	430	240	2290
8	217	754	400	1890	295	260	685	233	587	440	240	1610
9	289	727	380	1380	285	260	636	230	920	390	230	3100
10	257	1790	350	983	280	280	553	209	1760	330	230	2350
11	324	1480	300	795	280	270	506	197	1580	300	270	1330
12	254	1010	310	604	285	290	506	220	1550	275	350	950
13	238	1290	360	556	300	290	631	410	1120	260	250	800
14	217	1140	380	470	370	300	551	292	769	250	210	760
15	214	890	400	460	350	532	679	282	796	210	300	740
16	226	783	320	450	310	450	610	327	1730	195	526	720
17	465	715	330	430	280	430	689	319	1340	190	250	992
18	2060	624	290	420	260	2270	1060	294	997	190	190	800
19	698	561	300	410	260	2030	785	294	897	270	170	650
20	434	928	360	400	280	1300	665	395	3220	2240	250	580
21	398	1740	390	370	340	912	640	348	3130	1680	240	550
22	493	1050	370	340	360	676	540	296	4010	710	776	540
23	435	766	780	365	270	574	482	275	3460	1060	1320	530
24	677	650	600	360	240	534	439	257	2240	557	523	500
25	568	585	446	355	260	549	424	549	1560	472	390	420
26	482	570	400	694	260	612	378	700	1080	398	310	370
27	427	600	711	571	260	655	325	406	2780	533	270	320
28	404	550	1600	500	250	883	310	339	2550	1060	265	310
29	376	530	822	460	---	1020	286	257	1340	521	580	300
30	365	520	566	493	---	876	265	300	890	350	380	300
31	360	---	490	535	---	750	---	1450	---	300	330	---
TOTAL	13222	25297	14835	17056	8957	19103	20169	10652	46288	16870	10840	24952
MEAN	427	843	479	550	320	616	672	344	1543	544	350	832
MAX	2060	1790	1600	1890	542	2270	1560	1450	4010	2240	1320	3100
MIN	209	350	290	340	240	230	265	197	507	190	170	300
CFSM	.58	1.15	.65	.75	.44	.84	.92	.47	2.10	.74	.48	1.13
IN.	.67	1.28	.75	.86	.45	.97	1.02	.54	2.35	.85	.55	1.26

CAL YR 1988 TOTAL 172913 MEAN 472 MAX 2060 MIN 94 CFSM .64 IN 8.76
WTR YR 1989 TOTAL 228241 MEAN 625 MAX 4010 MIN 170 CFSM .85 IN 11.57

04165500 CLINTON RIVER AT MOUNT CLEMENS, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1969, 1973 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: October 1974 to September 1981.
WATER TEMPERATURE: October 1974 to September 1981.

INSTRUMENTATION.--Water-quality monitor from Aug. 13, 1975 to Sept. 6, 1981.

REMARKS.--Quarterly cross-sectional samples were collected at bridge. Daily-mean discharge is reported at sample time.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1975-76, 1978-81): Maximum, 3,580 microsiemens, Jan. 26, 1978; minimum, 126 microsiemens, July 29, 1976.
WATER TEMPERATURE (water years 1975-81): Maximum, 29.5°C, Sept. 20, 1978; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, IN CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
DEC 20...	1200	360	--	8.2	1.5	3.6	12.5	92	5100	E3800
MAR 09...	1200	260	991	8.2	1.0	6.2	15.0	106	310	190
JUN 28...	1200	2550	529	8.2	21.5	38	6.3	73	2700	2900
SEP 21...	1200	550	789	8.3	18.0	15	7.9	85	K1200	390

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
DEC 20...	310	97	80	26	79	36	2	3.5	256	0
MAR 09...	290	98	78	24	100	42	3	5.6	239	0
JUN 28...	200	42	57	14	27	22	0.9	5.0	193	0
SEP 21...	280	68	74	23	54	29	1	4.5	259	0

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)
DEC 20...	210	59	140	0.3	4.6	538	0.73	523	0.03
MAR 09...	196	73	160	0.4	4.2	585	0.80	411	0.04
JUN 28...	158	32	48	0.2	7.0	319	0.43	2200	0.05
SEP 21...	212	49	88	0.3	7.2	435	0.59	646	0.03

04165500 CLINTON RIVER AT MOUNT CLEMENS, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N)	NITRO- GEN, AMMONIA TOTAL (MG/L AS N)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS- PHOROUS TOTAL (MG/L AS P)	PHOS- PHOROUS DIS- SOLVED (MG/L AS P)	PHOS- PHOROUS ORTHO, DIS- SOLVED (MG/L AS P)	ALUM- INUM, DIS- SOLVED (UG/L AS AL)	ARSENIC DIS- SOLVED (UG/L AS AS)	BARIUM, DIS- SOLVED (UG/L AS BA)
DEC 20...	3.0	0.22	0.22	0.80	0.14	0.09	0.06	<10	1	53
MAR 09...	3.3	--	0.25	--	--	0.08	0.06	<10	1	58
JUN 28...	1.4	0.09	0.10	0.90	0.13	0.07	0.08	30	2	37
SEP 21...	2.0	0.09	0.07	1.0	0.17	0.10	0.09	10	2	56

DATE	BERYL- LIUM, DIS- SOLVED (UG/L AS BE)	CADMIUM DIS- SOLVED (UG/L AS CD)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR)	COBALT, DIS- SOLVED (UG/L AS CO)	COPPER, DIS- SOLVED (UG/L AS CU)	IRON, DIS- SOLVED (UG/L AS FE)	LEAD, DIS- SOLVED (UG/L AS PB)	LITHIUM DIS- SOLVED (UG/L AS LI)	MANGA- NESE, DIS- SOLVED (UG/L AS MN)	MERCURY DIS- SOLVED (UG/L AS HG)
DEC 20...	<0.5	<1	2	<3	2	13	<5	9	33	<0.1
MAR 09...	<0.5	<1	<1	<3	2	22	<5	9	56	0.1
JUN 28...	<0.5	<1	1	<3	2	54	<1	5	13	<0.1
SEP 21...	<0.5	<1	<1	<3	3	5	<1	7	19	<0.1

DATE	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO)	NICKEL, DIS- SOLVED (UG/L AS NI)	SELE- NIUM, DIS- SOLVED (UG/L AS SE)	SILVER, DIS- SOLVED (UG/L AS AG)	STRON- TIUM, DIS- SOLVED (UG/L AS SR)	VANA- DIUM, DIS- SOLVED (UG/L AS V)	ZINC, DIS- SOLVED (UG/L AS ZN)	SEDI- MENT, SUS- PENDED (MG/L)	SEDI- MENT, DIS- CHARGE, SUS- PENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
DEC 20...	<10	7	<1	<1.0	220	<6	12	6	5.8	96
MAR 09...	10	15	<1	<1.0	230	<6	21	11	7.7	95
JUN 28...	<10	3	<1	<1.0	170	<6	11	98	675	95
SEP 21...	<10	3	<1	<1.0	230	<6	12	38	56	100

04166000 RIVER ROUGE AT BIRMINGHAM, MI

LOCATION.--Lat 42°32'45", long 83°13'25", in NW1/4 sec.36, T.2 N., R.10 E., Oakland County, Hydrologic Unit 04090004, on left bank 25 ft downstream from mouth of Quarton Lake outlet, and 100 ft upstream from bridge on Maple Road at Birmingham.

DRAINAGE AREA.--33.3 mi^2. Prior to water year 1971, drainage area was 36.9 mi^2. An area of 3.6 mi^2 noncontributing since then.

PERIOD OF RECORD.--June 1950 to current year.

REVISED RECORDS.--WSP 1387: 1951-52(M). WSP 1557: Drainage area.

GAGE.--Water-stage recorder. Concrete control since July 27, 1962. Datum of gage is 715.94 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: June 10 to July 18. Records good except for estimated daily discharges, which are poor. Occasional regulation by Quarton Lake upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--20 years (water years 1951-70), 15.3 ft^3/s, 5.63 in/yr; 19 years (water years 1971-89), 23.2 ft^3/s, 9.46 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,390 ft^3/s, June 26, 1968, gage height, 8.70 ft; minimum, 0.10 ft^3/s, Aug. 8, 9, 1963; minimum gage height, 1.02 ft, Oct. 12, 1961.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 180 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Jan. 8	0400	375	4.31	July 20	1200	278	3.79
Mar. 13	0700	247	3.61	Aug. 22	1800	192	3.29
June 20	--	unknown	unknown	Sept. 7	0700	255	3.66
June 21	--	*900	unknown				

Minimum daily discharge, 7.0 ft^3/s, July 18.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	8.6	8.8	15	17	19	8.9	18	10	52	30	13	41
2	47	8.3	14	17	16	9.0	17	9.4	34	27	9.5	33
3	22	7.6	14	16	14	9.0	58	9.2	32	24	9.9	15
4	12	14	15	15	13	15	61	9.1	36	22	11	12
5	10	64	15	14	13	24	42	11	24	20	14	10
6	8.5	79	14	16	13	12	31	11	21	18	11	35
7	8.1	46	14	38	11	9.9	26	9.8	28	16	8.8	156
8	7.4	34	14	218	10	9.3	23	9.3	38	15	8.5	74
9	10	27	12	52	9.7	9.5	22	9.4	40	14	8.2	99
10	9.5	112	12	31	10	9.9	20	9.2	72	15	7.9	81
11	10	50	11	24	9.9	11	19	8.4	30	13	11	48
12	10	28	10	29	10	13	23	13	22	12	12	37
13	9.3	58	11	24	11	11	27	22	22	11	9.7	32
14	7.9	34	12	19	15	12	24	13	24	10	9.9	33
15	7.6	24	12	19	15	19	24	10	60	9.0	22	33
16	9.2	24	11	18	12	14	21	9.3	80	10	23	45
17	30	19	10	17	10	16	28	9.0	40	8.0	12	54
18	102	16	9.8	17	10	160	30	8.9	30	7.0	9.1	26
19	31	16	10	17	9.9	48	22	8.9	70	10	8.2	22
20	18	52	12	17	10	29	19	14	250	168	13	20
21	14	69	14	14	13	25	20	13	400	63	14	17
22	14	34	12	14	13	19	17	9.0	500	41	74	17
23	18	23	59	13	10	17	15	7.7	170	32	53	15
24	29	20	32	13	9.4	17	16	7.2	80	24	21	13
25	25	19	23	13	9.6	17	16	23	50	19	14	13
26	17	18	18	40	9.8	18	14	30	45	16	12	12
27	13	20	42	23	9.7	19	12	15	120	18	12	11
28	14	17	83	17	9.6	24	11	9.9	70	59	13	11
29	12	15	32	17	---	31	11	8.2	45	26	49	9.8
30	8.1	16	22	22	---	24	11	15	35	16	22	9.3
31	8.5	---	20	19	---	20	---	113	---	14	14	---
TOTAL	550.7	972.7	604.8	840	325.6	680.5	698	464.9	2520	787.0	529.7	1034.1
MEAN	17.8	32.4	19.5	27.1	11.6	22.0	23.3	15.0	84.0	25.4	17.1	34.5
MAX	102	112	83	218	19	160	61	113	500	168	74	156
MIN	7.4	7.6	9.8	13	9.4	8.9	11	7.2	21	7.0	7.9	9.3
CFSM	.54	.97	.59	.81	.35	.66	.70	.45	2.52	.76	.51	1.04
IN.	.62	1.09	.68	.94	.36	.76	.78	.52	2.82	.88	.59	1.16

CAL YR 1988 TOTAL 6843.9 MEAN 18.7 MAX 112 MIN 3.3 CFSM .56 IN 7.65
WTR YR 1989 TOTAL 10008.0 MEAN 27.4 MAX 500 MIN 7.0 CFSM .82 IN 11.18

04166100 RIVER ROUGE AT SOUTHFIELD, MI

LOCATION.--Lat 42°26'52", long 83°17'52", in SW1/4 sec.32, T.1 N., R.10 E., Oakland County, Hydrologic Unit 04090004, on right bank at downstream side of bridge on Beech Road at Southfield, and 4.2 mi east of Farmington.

DRAINAGE AREA.--87.9 mi².

PERIOD OF RECORD.--April 1958 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 609.62 ft, City of Southfield datum. Prior to Sept. 30, 1958, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 13-22, Dec. 29 to Jan. 5, Feb. 3 to Mar. 12, and Mar. 14. Records fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--31 years, 63.4 ft³/s, 9.79 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,900 ft³/s, June 26, 1968, gage height, 19.04 ft; minimum, 0.1 ft³/s, Aug. 2, 1964, gage height, 1.15 ft.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 700 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Oct. 18	0700	776	9.79	June 20	0500	1,090	10.68
Nov. 10	1400	803	9.63	June 21	2300	*2,740	*15.09
Jan. 8	0900	1,120	10.79	July 20	1900	716	9.50
Mar. 18	1000	905	10.03	Sept. 10	0200	790	9.84

Minimum discharge, 18 ft³/s, Aug. 10; minimum gage height, 2.94 ft, Oct. 1.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	23	23	49	54	61	28	55	33	182	81	28	104
2	150	23	44	48	53	29	51	33	106	77	24	89
3	70	21	42	46	44	30	233	32	102	73	23	41
4	38	43	42	43	42	50	220	30	116	68	26	37
5	30	229	42	45	41	65	136	38	63	61	47	30
6	27	324	41	46	40	40	96	34	51	52	32	28
7	24	148	39	58	35	32	77	30	46	47	24	460
8	23	106	38	886	32	30	67	29	79	42	20	184
9	35	75	36	167	31	31	66	28	89	39	19	381
10	33	557	34	102	32	32	60	28	209	37	31	355
11	37	187	34	76	31	36	55	26	75	34	69	109
12	29	98	33	87	33	41	64	30	59	31	38	77
13	26	215	35	76	36	37	76	73	63	29	31	64
14	24	119	38	61	47	36	60	40	66	28	25	69
15	23	82	37	57	47	78	74	32	176	26	38	70
16	28	84	32	49	38	47	58	30	240	32	72	99
17	87	68	31	46	33	41	79	27	107	30	35	161
18	488	54	31	46	32	632	106	26	82	23	25	71
19	87	52	32	49	31	164	66	26	199	23	22	52
20	46	185	35	48	32	95	55	55	723	408	37	46
21	35	330	43	43	41	85	77	39	1070	196	37	40
22	40	111	38	43	41	64	57	29	1610	88	38	36
23	50	80	228	39	32	57	47	26	481	66	115	40
24	93	67	103	38	30	54	44	24	203	57	57	35
25	55	59	74	38	30	56	48	113	144	44	36	32
26	41	56	53	116	31	59	46	100	117	37	27	35
27	32	66	143	74	31	61	41	49	367	43	24	30
28	30	55	328	52	30	74	38	34	198	69	25	31
29	28	48	94	55	---	124	36	28	122	52	92	30
30	24	46	70	70	---	77	36	33	96	38	55	26
31	22	---	62	63	---	64	---	373	---	31	31	---
TOTAL	1778	3611	1981	2721	1037	2349	2224	1528	7241	1962	1203	2862
MEAN	57.4	120	63.9	87.8	37.0	75.8	74.1	49.3	241	63.3	38.8	95.4
MAX	488	557	328	886	61	632	233	373	1610	408	115	460
MIN	22	21	31	38	30	28	36	24	46	23	19	26
CFSM	.65	1.37	.73	1.00	.42	.86	.84	.56	2.74	.72	.44	1.09
IN.	.75	1.53	.84	1.15	.44	.99	.94	.65	3.06	.83	.51	1.21

CAL YR 1988 TOTAL 21851.5 MEAN 59.7 MAX 557 MIN 8.6 CFSM .68 IN 9.25
WTR YR 1989 TOTAL 30497.0 MEAN 83.6 MAX 1610 MIN 19 CFSM .95 IN 12.91

04166200 EVANS DITCH AT SOUTHFIELD, MI

LOCATION.--Lat 42°27'28", long 83°16'03", in SE1/4 sec.28, T.1 N., R.10 E., Oakland County, Hydrologic Unit 04090004, on right bank 70 ft upstream from bridge on Nine Mile Road at Southfield, 1.6 mi upstream from mouth, and 5.5 mi east of Farmington.

DRAINAGE AREA.--9.49 mi^2.

PERIOD OF RECORD.--September 1958 to current year.

GAGE.--Water-stage recorder. Datum of gage is 615.07 ft, City of Southfield datum.

REMARKS.--Estimated daily discharges: Oct. 1-5, Dec. 13-15, 27, and Feb. 5-22. Records fair except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--31 years, 8.50 ft^3/s, 12.16 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,200 ft^3/s, Oct. 1, 1981, gage height, 15.03 ft, from floodmarks, from rating curve extended above 410 ft^3/s; no flow June 13-15, 1986, caused by regulation of unknown source.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 330 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Oct. 18	0215	*416	*9.64	July 20	0900	*416	9.63
Jan. 8	0100	351	9.18	Sept. 6	2030	356	9.22
June 19	2015	347	9.14	Sept. 9	0015	380	9.39

Minimum daily discharge, 1.3 ft^3/s, Oct. 13, Mar. 8.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.8	4.8	5.1	4.0	5.4	1.4	4.2	2.9	16	3.1	2.0	25
2	25	4.8	3.8	3.9	4.1	1.4	5.0	2.9	15	2.7	2.0	2.9
3	2.5	4.2	3.8	3.6	3.5	1.4	40	2.9	21	2.6	1.9	1.8
4	1.6	14	3.6	3.3	3.0	10	27	2.7	7.1	2.5	2.2	1.6
5	1.4	81	3.8	3.2	2.8	4.9	13	4.6	4.0	2.5	10	1.6
6	1.5	26	3.8	3.6	2.7	1.6	7.2	2.9	3.4	2.4	2.0	49
7	1.5	13	3.6	25	2.6	1.4	5.8	2.5	4.4	2.1	1.7	88
8	1.7	13	3.1	65	2.5	1.3	5.2	2.6	6.6	2.0	1.4	44
9	5.9	11	2.8	6.8	2.3	1.5	6.0	2.5	35	1.9	1.6	81
10	4.0	92	2.9	5.0	2.2	1.5	4.9	2.3	9.9	1.9	9.8	17
11	2.7	10	2.7	4.2	2.2	1.7	4.1	2.3	3.6	2.0	7.9	5.1
12	1.9	7.0	2.5	9.2	2.2	2.0	9.3	7.3	7.3	2.2	1.9	3.8
13	1.3	35	2.4	4.2	2.5	2.0	5.6	11	5.1	2.3	1.7	4.0
14	1.4	8.8	2.4	3.6	3.5	2.4	4.3	3.0	18	1.8	1.6	6.5
15	1.6	6.3	3.0	4.3	2.8	15	11	2.9	31	1.7	32	3.8
16	7.4	9.7	2.4	3.9	2.3	2.4	4.7	2.8	39	1.8	5.8	21
17	28	5.3	2.3	3.7	2.1	4.3	18	2.5	9.7	1.7	2.5	5.8
18	78	4.3	2.2	5.2	2.1	86	11	2.4	5.8	1.7	2.0	3.3
19	6.0	4.6	2.6	4.4	2.0	7.7	5.8	2.9	60	6.7	1.8	2.8
20	4.0	67	4.8	3.8	2.1	8.0	4.9	10	16	150	14	2.6
21	4.3	18	3.4	3.0	3.0	6.5	12	3.0	130	7.6	2.6	2.4
22	6.6	8.4	2.9	3.0	2.1	4.7	5.1	2.4	20	4.4	15	2.4
23	18	6.9	33	3.0	1.8	4.4	4.3	2.5	7.9	3.5	5.7	2.5
24	11	6.0	10	3.0	1.5	4.4	4.2	2.4	6.3	4.0	2.0	2.4
25	6.0	5.2	5.8	3.1	1.5	4.6	5.9	36	4.9	3.1	1.8	2.3
26	3.7	5.3	3.9	19	1.7	4.7	4.1	17	6.6	2.6	1.7	2.1
27	3.0	7.1	20	4.8	1.6	5.5	3.5	2.8	44	5.7	1.5	2.0
28	4.0	4.5	33	3.9	1.5	9.1	3.3	2.4	5.8	3.5	13	2.0
29	3.5	3.9	7.4	5.6	---	14	3.2	2.2	3.8	2.3	13	1.9
30	3.5	3.9	5.4	6.6	---	5.6	3.0	7.0	3.4	3.1	2.4	1.8
31	3.9	---	4.3	5.5	---	4.8	---	77	---	2.3	1.7	---
TOTAL	246.7	491.0	192.7	230.4	69.6	226.2	245.6	230.6	550.6	237.7	166.2	392.4
MEAN	7.96	16.4	6.22	7.43	2.49	7.30	8.19	7.44	18.4	7.67	5.36	13.1
MAX	78	92	33	65	5.4	86	40	77	130	150	32	88
MIN	1.3	3.9	2.2	3.0	1.5	1.3	3.0	2.2	3.4	1.7	1.4	1.6
CFSM	.84	1.73	.66	.78	.26	.77	.86	.78	1.94	.81	.57	1.38
IN.	.97	1.92	.76	.90	.27	.89	.96	.90	2.16	.93	.65	1.54

CAL YR 1988 TOTAL 2703.94 MEAN 7.39 MAX 111 MIN .84 CFSM .78 IN 10.60
WTR YR 1989 TOTAL 3279.70 MEAN 8.99 MAX 150 MIN 1.3 CFSM .95 IN 12.85

04166300 UPPER RIVER ROUGE AT FARMINGTON, MI

LOCATION.--Lat 42°27'52", long 83°22'11", in NW1/4 sec.27, T.1 N., R.9 E., Oakland County, Hydrologic Unit 04090004, on left bank 800 ft downstream from bridge on Shiawassee Road at Farmington.

DRAINAGE AREA.--17.5 mi².

PERIOD OF RECORD.--March 1958 to current year.

REVISED RECORDS.--WSP 1912: 1959(M), 1960(M).

GAGE.--Water-stage recorder and concrete control. Datum of gage is 690.4 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 11-23, Dec. 29 to Jan. 6, Jan. 9-16, and Feb. 5 to Mar. 11. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--31 years, 12.4 ft³/s, 9.62 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,500 ft³/s, June 25, 1968, gage height, 8.70 ft; minimum, 0.07 ft³/s, Aug. 30, 1966, result of regulation; minimum daily, 0.32 ft³/s, Aug. 10, 1964, Aug. 29, 1966.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 120 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Oct. 18	0400	137	4.14	June 21	1630	*885	*a7.10
Nov. 10	0800	140	4.16	June 27	1200	149	4.22
Jan. 8	0315	252	a4.79	Sept. 7	0900	171	4.34
Mar. 18	0500	164	4.30	Sept. 9	2000	185	4.42
June 19	2200	368	5.35				

a From graph based on gage readings.

Minimum daily discharge, 4.4 ft³/s, Aug. 9.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.9	6.3	10	11	14	5.5	14	8.2	50	15	5.6	31
2	17	6.4	9.8	9.3	11	5.6	13	8.2	29	13	5.3	23
3	13	6.1	9.4	8.3	9.6	5.7	52	8.0	23	12	4.9	11
4	8.9	9.5	9.1	8.0	8.2	10	54	7.9	23	11	5.1	7.8
5	7.2	54	8.6	7.8	8.0	15	36	9.6	14	9.5	9.4	6.7
6	6.1	75	8.5	8.5	7.7	8.0	24	9.0	11	8.5	7.6	8.9
7	5.6	39	8.6	20	7.4	6.3	18	8.2	9.3	8.4	6.3	126
8	5.2	29	8.1	139	6.9	6.0	15	7.6	8.3	7.7	5.3	53
9	6.7	21	7.5	60	6.5	6.0	15	7.4	18	7.5	4.4	78
10	7.2	104	6.8	45	6.2	6.3	13	7.1	40	6.2	7.0	69
11	8.7	60	6.7	27	6.2	7.0	12	6.9	17	5.9	14	28
12	7.3	29	6.6	20	6.4	8.8	13	8.0	12	6.0	29	17
13	6.4	50	6.5	15	6.8	7.6	14	13	11	6.1	12	13
14	5.9	31	6.6	12	8.4	8.0	12	11	18	5.5	7.8	14
15	5.6	20	7.0	10	9.5	14	15	9.1	25	5.1	11	13
16	6.8	18	6.5	9.3	8.0	9.8	12	8.6	25	5.0	11	26
17	28	15	6.2	8.6	7.1	12	16	7.9	14	4.6	7.9	33
18	95	13	6.2	8.8	6.6	110	18	7.6	12	4.7	6.4	16
19	36	12	6.7	9.2	6.5	41	14	7.6	89	6.6	5.5	12
20	17	41	8.5	9.0	7.0	25	12	13	177	67	9.0	10
21	13	62	7.8	8.1	9.0	18	16	11	429	30	7.6	9.0
22	12	30	7.0	7.8	8.0	13	14	8.5	450	14	13	8.4
23	15	20	40	7.7	7.1	11	12	7.7	103	9.9	17	7.2
24	21	16	23	7.5	6.5	11	11	7.1	58	8.0	10	6.7
25	16	14	15	7.7	6.1	12	11	31	36	7.6	7.1	6.5
26	12	12	11	24	6.0	13	11	32	27	6.6	6.1	6.4
27	9.9	15	26	16	6.0	14	9.8	15	89	6.8	5.2	6.0
28	9.1	12	61	12	5.7	19	9.4	10	50	8.0	7.1	5.8
29	8.1	11	30	13	---	33	9.1	8.6	28	6.5	29	6.0
30	7.2	10	20	16	---	22	8.7	11	21	6.4	12	5.5
31	5.9	---	15	14	---	17	---	75	---	6.2	7.9	---
TOTAL	427.7	841.3	409.7	579.6	212.4	500.6	504.0	390.8	1916.6	325.3	296.5	663.9
MEAN	13.8	28.0	13.2	18.7	7.59	16.1	16.8	12.6	63.9	10.5	9.56	22.1
MAX	95	104	61	139	14	110	54	75	450	67	29	126
MIN	4.9	6.1	6.2	7.5	5.7	5.5	8.7	6.9	8.3	4.6	4.4	5.5
CFSM	.79	1.60	.75	1.07	.43	.92	.96	.72	3.65	.60	.55	1.26
IN.	.91	1.79	.87	1.23	.45	1.06	1.07	.83	4.07	.69	.63	1.41

CAL YR 1988 TOTAL 4806.7 MEAN 13.1 MAX 104 MIN 2.0 CFSM .75 IN 10.22
WTR YR 1989 TOTAL 7068.4 MEAN 19.4 MAX 450 MIN 4.4 CFSM 1.11 IN 15.02

04166500 RIVER ROUGE AT DETROIT, MI

LOCATION.--Lat 42°22'20", long 83°15'20", in SW1/4 sec.27, T.1 S., R.10 E., Wayne County, Hydrologic Unit 04090004, on right bank 500 ft upstream from bridge on Plymouth Road at Detroit, and 4 mi upstream from Middle River Rouge.

DRAINAGE AREA.--187 mi².

PERIOD OF RECORD.--October 1930 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1034: 1933(M). WSP 1054: 1939, 1943, 1945(M). WSP 1437: 1931-32, 1934, 1936(M), 1937-38, 1944(M), 1945. WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 584.00 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 16, 1948, nonrecording gage at site 1 mi downstream at datum 4.6 ft lower.

REMARKS.--Estimated daily discharges: Dec. 11-21, Dec. 29 to Jan. 5, Jan. 22, 23, and Feb. 5 to Mar. 8. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--59 years, 118 ft³/s, 8.57 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 13,000 ft³/s, Apr. 5, 1947; maximum gage height, 23.0 ft, Apr. 6, 1947, from floodmark, site and datum then in use; minimum discharge, 1.8 ft³/s, Aug. 1, 2, 1964, gage height, 3.00 ft.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,200 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Oct. 18	1200	1,220	11.98	June 22	1000	*3,750	*17.72
Jan. 8	1500	1,310	12.07	July 20	1900	1,240	11.83
June 20	1200	1,370	12.27	Sept. 7	1800	1,250	11.85

Minimum discharge, 32 ft³/s, Aug. 9, gage height, 4.27 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	37	41	81	92	99	45	95	60	535	116	51	200
2	240	39	79	80	89	41	87	58	278	103	46	180
3	173	39	73	75	72	46	445	56	192	97	42	78
4	70	53	68	72	61	70	395	54	259	90	42	57
5	52	378	68	73	65	110	285	70	121	83	99	51
6	43	803	66	77	61	76	173	65	93	72	70	89
7	41	352	66	110	57	54	132	55	84	65	47	894
8	36	208	64	1070	54	49	114	53	106	59	40	486
9	75	173	60	588	53	47	113	51	105	56	38	907
10	69	801	54	209	52	48	102	50	302	60	46	725
11	68	555	56	146	52	52	90	49	138	50	149	211
12	52	197	54	142	53	59	93	51	94	46	106	135
13	43	369	53	142	56	58	133	149	115	48	92	106
14	41	252	58	100	78	54	98	80	111	46	51	105
15	37	149	58	103	72	144	142	64	385	43	115	135
16	51	147	54	81	62	85	105	60	704	44	301	94
17	183	135	49	73	53	67	149	56	201	45	75	333
18	1070	100	48	75	52	824	250	51	163	39	52	185
19	286	92	49	75	51	453	125	53	208	57	45	106
20	108	281	53	76	56	175	97	107	1210	943	103	83
21	74	699	72	60	69	153	137	92	835	547	88	73
22	84	224	62	67	62	106	114	60	3220	146	63	66
23	92	145	351	63	53	92	86	51	1630	102	206	62
24	209	119	238	59	51	85	76	48	419	87	96	59
25	111	102	155	61	48	88	83	271	240	75	61	55
26	78	96	88	188	48	92	86	257	187	64	47	54
27	63	112	229	144	48	118	72	108	424	138	42	50
28	53	100	711	90	46	152	67	67	374	189	66	47
29	55	84	160	83	---	251	63	54	189	89	247	48
30	46	79	120	111	---	147	61	62	143	68	109	45
31	40	---	110	104	---	112	---	792	---	58	60	---
TOTAL	3680	6924	3507	4489	1673	3953	4068	3154	13065	3725	2695	5719
MEAN	119	231	113	145	59.8	128	136	102	436	120	86.9	191
MAX	1070	803	711	1070	99	824	445	792	3220	943	301	907
MIN	36	39	48	59	46	41	61	48	84	39	38	45
CFSM	.64	1.24	.60	.78	.32	.68	.73	.55	2.33	.64	.47	1.02
IN.	.73	1.38	.70	.89	.33	.79	.81	.63	2.60	.74	.54	1.14

CAL YR 1988	TOTAL 39783	MEAN 109	MAX 1070	MIN 12	CFSM .58	IN 7.91
WTR YR 1989	TOTAL 56652	MEAN 155	MAX 3220	MIN 36	CFSM .83	IN 11.27

04167000 MIDDLE RIVER ROUGE NEAR GARDEN CITY, MI

LOCATION.--Lat 42°20'55", long 83°18'45", in SW1/4 NW1/4 sec.6, T.2 S., R.10 E., Wayne County, Hydrologic Unit 04090004, on right bank 200 ft downstream from bridge on Inkster Road, 1.8 mi northeast of Garden City, and 6.0 mi upstream from mouth.

DRAINAGE AREA.--99.9 mi^2.

PERIOD OF RECORD.--October 1930 to September 1933 (published as "at Detroit"), June 1947 to September 1977, October 1977 to September 1983 (operated as a crest-stage partial-record station only), October 1983 to current year. Monthly discharge only for October, November, 1930, published in WSP 1307.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 600.95 ft above National Geodetic Vertical Datum of 1929. Nov. 21, 1930 to Sept. 30, 1933, nonrecording gage at site 4.8 mi downstream at datum 17.48 ft lower. June 6, 1947 to Oct. 18, 1948, nonrecording gage at site 200 ft upstream at present datum.

REMARKS.--Estimated daily discharges: Dec. 12, Feb. 8, 9, 24, Mar. 8, and Aug. 25-29. Records good. Occasional regulation by reservoirs upstream from station since 1956. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--39 years (water years 1931-33, 1948-77, 1984-89), 72.1 ft^3/s, 9.80 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,330 ft^3/s, June 26, 1968; maximum gage height, 10.50 ft, May 10, 1948; minimum discharge, 0.9 ft^3/s, Aug. 16, 1956.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 700 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
June 22	1400	*1,480	*9.40	No other peak greater than base discharge.			

Minimum discharge, 25 ft^3/s, Oct. 1, 8, Aug. 9, gage height, 1.88 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	27	39	61	67	87	35	85	46	369	90	36	138
2	131	39	59	61	82	33	81	44	235	78	32	91
3	74	36	56	55	67	33	268	46	188	71	30	52
4	46	51	53	53	56	60	235	44	161	66	35	36
5	35	277	51	50	52	81	199	52	98	60	49	31
6	29	369	51	52	51	62	143	47	75	57	47	66
7	28	227	50	95	48	50	109	56	62	56	35	432
8	27	154	48	424	46	43	91	45	53	52	28	339
9	57	132	45	304	43	36	85	43	56	48	26	408
10	48	408	44	160	41	37	77	42	59	44	28	305
11	54	288	42	113	39	39	69	40	52	41	104	155
12	39	166	42	101	39	46	71	46	52	38	86	95
13	31	202	40	87	44	49	73	83	59	38	51	82
14	28	151	42	70	53	50	66	56	75	36	33	97
15	27	115	45	65	52	100	72	50	146	35	56	89
16	46	110	39	61	48	71	72	48	237	32	123	108
17	138	92	38	57	43	62	119	42	106	31	55	188
18	452	78	36	55	39	326	139	40	101	31	37	105
19	162	72	37	58	37	222	91	41	137	46	30	79
20	84	213	44	59	41	133	75	78	274	288	75	68
21	63	291	50	53	61	107	84	54	367	123	51	61
22	68	186	47	49	57	81	73	46	1050	70	55	57
23	78	129	185	48	44	69	63	40	886	51	48	54
24	109	101	150	48	41	63	58	37	456	101	42	47
25	73	87	109	50	36	63	63	182	232	43	35	44
26	60	79	73	125	36	66	59	175	165	68	32	43
27	51	90	169	100	37	106	54	100	196	101	30	40
28	49	76	287	77	36	121	50	65	209	156	40	39
29	42	67	158	72	---	220	49	49	144	61	110	39
30	38	63	100	87	---	132	47	58	110	46	62	37
31	37	---	79	88	---	105	---	404	---	40	41	---
TOTAL	2231	4388	2330	2844	1356	2701	2820	2199	6410	2098	1542	3425
MEAN	72.0	146	75.2	91.7	48.4	87.1	94.0	70.9	214	67.7	49.7	114
MAX	452	408	287	424	87	326	268	404	1050	288	123	432
MIN	27	36	36	48	36	33	47	37	52	31	26	31
CFSM	.72	1.46	.75	.92	.48	.87	.94	.71	2.14	.68	.50	1.14
IN.	.83	1.63	.87	1.06	.50	1.01	1.05	.82	2.39	.78	.57	1.28

CAL YR 1988	TOTAL 27225	MEAN 74.4	MAX 452	MIN 15	CFSM .75	IN 10.14
WTR YR 1989	TOTAL 34344	MEAN 94.1	MAX 1050	MIN 26	CFSM .94	IN 12.79

04168000 LOWER RIVER ROUGE AT INKSTER, MI

LOCATION.--Lat 42°18'00", long 83°18'00", in SW1/4 SE1/4 sec.19, T.2 S., R.10 E., Wayne County, Hydrologic Unit 04090004, on right bank 10 ft downstream from bridge on John Daly Road, 0.6 mi northeast of Inkster, and 4.8 mi upstream from mouth.

DRAINAGE AREA.--83.2 mi².

PERIOD OF RECORD.--June 1947 to current year.

REVISED RECORDS.--WSP 1174: 1948(M). WSP 1437: 1949. WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 593.14 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 20, 1948, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Oct. 6, 7, 21, 22, Dec. 10-17, Dec. 29 to Jan. 15, Feb. 2 to Mar. 10, and Sept. 22, 23. Records fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--42 years, 53.0 ft³/s, 8.65 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,600 ft³/s, June 26, 1968, gage height, 13.62 ft; minimum, 0.2 ft³/s, Sept. 13, 1955, Jan. 23, 1961.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 687 ft³/s, May 31, gage height, 8.13 ft, no peak discharge above base discharge of 900 ft³/s; minimum, 0.82 ft³/s, Aug. 28, gage height, 2.57 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.4	9.7	26	30	91	8.7	78	19	586	11	10	60
2	53	8.9	23	25	60	8.4	69	18	309	9.4	7.9	26
3	23	8.5	21	20	35	8.2	333	18	160	8.8	6.0	19
4	12	15	20	18	25	20	321	16	173	8.7	12	3.9
5	7.1	181	18	17	19	30	192	20	89	8.2	25	2.2
6	5.4	308	18	17	15	20	116	19	53	7.6	7.9	33
7	4.2	159	17	45	13	15	80	28	37	6.7	4.2	138
8	3.3	94	16	380	12	13	63	19	51	5.4	3.0	49
9	16	78	14	120	11	11	55	17	88	4.6	2.7	63
10	11	327	12	60	11	13	46	15	104	4.3	2.5	76
11	9.7	215	11	40	11	16	39	15	48	4.0	7.5	28
12	9.6	89	10	35	11	21	40	18	40	3.9	9.9	16
13	9.2	123	9.7	30	12	22	39	36	44	4.4	11	13
14	8.6	98	10	27	13	25	34	24	29	4.0	4.6	27
15	7.9	61	14	25	18	71	33	20	56	4.0	6.1	30
16	18	58	13	23	14	56	32	19	141	3.6	13	34
17	57	51	11	20	12	39	85	17	62	2.9	5.2	83
18	263	36	8.6	22	12	333	177	16	43	3.5	3.5	40
19	69	29	8.8	27	11	175	101	17	51	18	2.2	19
20	31	129	13	29	11	101	71	35	89	144	16	14
21	20	295	19	18	13	83	56	23	57	36	9.8	11
22	19	113	16	21	16	60	48	17	213	19	13	10
23	30	68	93	18	12	48	37	14	80	11	20	8.9
24	44	50	93	17	11	44	30	12	46	11	6.4	6.9
25	34	41	69	19	9.8	48	33	84	31	18	2.5	6.2
26	22	36	35	77	9.5	53	36	106	27	35	1.6	5.4
27	16	40	109	72	9.2	57	31	50	32	77	1.1	4.9
28	15	38	281	43	9.0	80	27	27	23	80	33	4.4
29	12	31	95	48	---	353	23	19	16	26	47	4.2
30	10	27	45	93	---	181	21	20	13	20	11	4.0
31	9.7	---	35	90	---	106	---	325	---	13	5.4	---
TOTAL	853.1	2817.1	1184.1	1526	506.5	2119.3	2346	1103	2791	613.0	311.0	840.0
MEAN	27.5	93.9	38.2	49.2	18.1	68.4	78.2	35.6	93.0	19.8	10.0	28.0
MAX	263	327	281	380	91	353	333	325	586	144	47	138
MIN	3.3	8.5	8.6	17	9.0	8.2	21	12	13	2.9	1.1	2.2
CFSM	.33	1.13	.46	.59	.22	.82	.94	.43	1.12	.24	.12	.34
IN.	.38	1.26	.53	.68	.23	.95	1.05	.49	1.25	.27	.14	.38

CAL YR 1988 TOTAL 14630.7 MEAN 40.0 MAX 327 MIN 1.2 CFSM .48 IN 6.54
WTR YR 1989 TOTAL 17010.1 MEAN 46.6 MAX 586 MIN 1.1 CFSM .56 IN 7.61

04170000 HURON RIVER AT MILFORD, MI

LOCATION.--Lat 42°34'44", long 83°37'36", in NE1/4 sec.16, T.2 N., R.7 E., Oakland County, Hydrologic Unit 04090005, on left bank 40 ft downstream from bridge on General Motors Road, 0.5 mi downstream from Sherwood Creek, and 0.5 mi west of Milford.

DRAINAGE AREA.--132 mi^2.

PERIOD OF RECORD.--September 1948 to current year.

REVISED RECORDS.--WSP 1337: 1952(m). WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 880.00 ft above National Geodetic Vertical Datum of 1929. Prior to Apr. 1, 1970, at site 240 ft upstream at same datum.

REMARKS.--No estimated daily discharges. Records good. Flow below about 300 ft^3/s regulated by powerplant 1.5 mi upstream from station prior to May 20, 1957; occasional regulation for lake level control since. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--41 years, 97.6 ft^3/s, 10.04 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 648 ft^3/s, Oct. 3, 1981, gage height, 7.87 ft; maximum gage height, 8.26 ft, June 28, 1968; minimum daily discharge, 5.2 ft^3/s, Oct. 21, 1971.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 254 ft^3/s, June 24, gage height, 6.41 ft; minimum, 15 ft^3/s, July 13, gage height, 4.03 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	54	75	116	89	88	47	92	57	149	167	62	59
2	62	79	114	88	82	47	94	40	161	150	60	63
3	66	78	113	88	77	48	115	35	154	138	57	63
4	63	74	114	89	76	53	137	39	141	128	53	57
5	58	96	114	90	77	61	143	44	128	118	57	48
6	56	134	113	91	78	55	137	47	118	112	56	55
7	54	142	111	95	76	51	129	49	110	109	50	100
8	54	138	109	136	72	51	112	49	99	104	46	117
9	50	129	102	120	67	51	105	50	94	98	45	127
10	60	146	98	118	65	52	103	48	100	88	49	132
11	57	151	94	103	61	54	103	45	107	84	57	135
12	53	149	92	97	59	58	105	46	106	73	52	127
13	47	143	89	93	61	56	109	58	104	46	43	112
14	44	137	88	88	61	58	108	58	104	39	43	105
15	43	131	85	87	62	76	110	57	104	48	42	100
16	46	127	80	83	61	69	109	58	105	56	42	98
17	61	120	75	79	59	69	110	55	107	51	41	108
18	97	116	72	78	57	136	112	50	108	56	39	110
19	104	112	70	78	56	131	101	48	115	60	35	107
20	99	118	71	78	57	116	95	53	115	77	38	99
21	88	131	72	81	60	108	98	54	148	82	39	94
22	82	136	72	83	58	104	99	49	197	76	43	89
23	78	130	93	85	56	101	92	42	237	70	49	81
24	78	122	96	85	54	98	81	38	252	64	51	80
25	79	116	86	85	52	96	76	59	238	61	49	78
26	78	114	79	92	50	98	76	74	211	58	47	73
27	77	113	91	91	50	97	73	71	207	57	44	68
28	74	113	110	85	49	105	70	63	204	65	44	64
29	74	116	105	82	---	113	66	60	211	66	52	60
30	74	116	96	85	---	107	60	62	191	60	52	58
31	73	---	91	86	---	98	---	112	---	60	48	---
TOTAL	2083	3602	2911	2808	1781	2464	3020	1670	4425	2521	1485	2667
MEAN	67.2	120	93.9	90.6	63.6	79.5	101	53.9	148	81.3	47.9	88.9
MAX	104	151	116	136	88	136	143	112	252	167	62	135
MIN	43	74	70	78	49	47	60	35	94	39	35	48
CFSM	.51	.91	.71	.69	.48	.60	.77	.41	1.12	.62	.36	.67
IN.	.59	1.02	.82	.79	.50	.69	.85	.47	1.25	.71	.42	.75

CAL YR 1988 TOTAL 28889 MEAN 78.9 MAX 186 MIN 10 CFSM .60 IN 8.14
WTR YR 1989 TOTAL 31437 MEAN 86.1 MAX 252 MIN 35 CFSM .65 IN 8.86

04170490 KENT LAKE NEAR NEW HUDSON, MI

LOCATION.--Lat 42°30'45", long 83°40'34", in sec.1, T.1 N., R.6 E., Livingston County, Hydrologic Unit 04090005, at Kent Lake Dam, 2 mi upstream from Woodruff Creek, and 3 mi west of New Hudson.

DRAINAGE AREA.--148 mi².

PERIOD OF RECORD.--April 1949 to current year.

GAGE.--Water-stage recorder. Datum of gage is 868.00 ft above National Geodetic Vertical Datum of 1929 (Huron-Clinton Metropolitan Authority bench mark).

REMARKS.--The inlet and outlet is the Huron River which enters the northeast end of the lake and leaves the southwest end of the lake. Streamflow records are currently collected on the Huron River at sites about 1 mi upstream (04170000) and 150 ft downstream (04170500) from Kent Lake. Maximum depth 38 ft, surface area 1,200 acres. A concrete dam with steel drum spillway is used to control the lake level.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 16.68 ft, Apr. 6, 1950; minimum, 11.60 ft, Mar. 7, 8, 1968.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 15.99 ft, June 27; minimum, 12.39 ft, Feb. 28.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	15.53	---	13.36	12.57	12.55	12.40	12.59	14.88	15.79	15.87	15.49	15.55
2	15.59	---	---	12.56	12.53	12.40	12.63	14.93	15.82	15.82	15.48	15.56
3	15.58	---	---	12.56	12.51	12.41	12.87	14.97	15.84	15.79	15.48	15.55
4	15.55	14.91	---	12.56	12.50	12.42	13.12	15.00	15.84	15.76	15.48	15.54
5	15.54	14.87	---	12.56	12.50	12.45	13.26	15.03	15.80	15.73	15.49	15.53
6	15.53	14.90	---	12.56	12.50	12.44	13.32	15.06	15.76	15.70	15.49	15.54
7	15.52	14.92	---	12.57	12.49	12.43	13.38	15.06	15.74	15.68	15.46	15.63
8	15.52	14.93	---	12.65	12.48	12.42	13.53	15.08	15.71	15.65	15.45	15.68
9	15.53	14.81	---	12.68	12.47	12.42	13.61	15.10	15.67	15.63	15.44	15.73
10	15.52	14.57	---	12.67	12.47	12.42	13.63	15.12	15.66	15.61	15.45	15.75
11	15.53	14.45	---	12.66	12.46	12.43	13.70	15.10	15.65	15.60	15.46	15.77
12	15.50	14.38	---	12.64	12.45	12.44	13.84	15.10	15.67	15.57	15.47	15.76
13	15.49	14.35	---	12.61	12.46	12.43	13.93	15.14	15.68	15.54	15.46	15.75
14	15.51	14.32	---	12.59	12.46	12.43	13.99	15.15	15.68	15.48	15.45	15.73
15	15.59	14.25	---	12.58	12.46	12.47	14.11	15.23	15.68	15.45	15.45	15.71
16	15.66	13.98	---	12.56	12.46	12.48	14.15	15.30	15.68	15.45	15.47	15.70
17	15.67	13.85	---	12.55	12.45	12.49	14.25	15.34	15.67	15.45	15.46	15.72
18	15.66	13.84	---	12.54	12.45	12.64	14.44	15.36	15.67	15.45	15.45	15.72
19	15.66	13.84	12.48	12.53	12.44	12.68	14.56	15.37	15.69	15.48	15.44	15.72
20	15.64	13.86	12.48	12.53	12.44	12.69	14.60	15.40	15.72	15.56	15.45	15.71
21	15.62	13.88	12.49	12.52	12.46	12.66	14.64	15.40	15.80	15.55	15.46	15.70
22	15.63	13.88	12.49	12.52	12.45	12.63	14.66	15.40	15.88	15.54	15.47	15.69
23	15.61	13.88	12.54	12.53	12.44	12.62	14.64	15.39	15.92	15.54	15.51	15.65
24	15.58	13.88	12.57	12.53	12.43	12.60	14.65	15.37	15.96	15.53	15.51	15.63
25	15.58	13.86	12.56	12.54	12.43	12.59	14.75	15.50	15.97	15.51	15.49	15.62
26	---	13.85	12.55	12.56	12.42	12.58	14.81	15.55	15.94	15.50	15.48	15.63
27	---	13.83	12.58	12.56	12.42	12.57	14.85	15.57	15.97	15.49	15.47	15.62
28	---	13.75	12.61	12.55	12.41	12.59	14.87	15.57	15.95	15.53	15.49	15.60
29	---	13.52	12.62	12.55	---	12.65	14.86	15.56	15.92	15.51	15.50	15.60
30	---	13.41	12.60	12.54	---	12.63	14.86	15.58	15.91	15.50	15.51	15.59
31	---	---	12.59	12.54	---	12.62	---	15.73	---	15.50	15.50	---
MEAN	---	---	---	12.57	12.46	12.52	14.04	15.27	15.79	15.58	15.47	15.66
MAX	---	---	---	12.68	12.55	12.69	14.87	15.73	15.97	15.87	15.51	15.77
MIN	---	---	---	12.52	12.41	12.40	12.59	14.88	15.65	15.45	15.44	15.53

04170500 HURON RIVER NEAR NEW HUDSON, MI

LOCATION.--Lat 42°30'45", long 83°40'35", in NE1/4 sec.1, T.1 N., R.6 E., Livingston County, Hydrologic Unit 04090005, on right bank 150 ft downstream from Kent Lake Dam, 2 mi upstream from Woodruff Creek, and 3 mi west of New Hudson.

DRAINAGE AREA.--148 mi^2.

PERIOD OF RECORD.--August 1948 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 868.00 ft above National Geodetic Vertical Datum of 1929 (Huron-Clinton Metropolitan Authority bench mark).

REMARKS.--Estimated daily discharges: Nov. 7, 8, 18, July 20 to Aug. 28, and Sept. 8-30. Records poor. Occasional regulation by Kent Lake (see preceding page). Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--41 years, 111 ft^3/s, 10.18 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,080 ft^3/s, Dec. 29, 1950, gage height, 5.05 ft, from rating curve extended above 600 ft^3/s; minimum, 2.6 ft^3/s, May 27, 1963, gage height, 0.53 ft; minimum daily, 6.4 ft^3/s, May 7, 1963.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 360 ft^3/s, Nov. 9, gage height, 3.28 ft; minimum daily, 12 ft^3/s, May 15.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	57	189	156	109	98	61	125	43	144	192	70	78
2	77	141	140	107	93	60	96	17	159	177	67	87
3	73	158	139	105	87	60	57	22	164	159	64	81
4	65	170	132	104	83	64	80	26	166	150	62	77
5	61	159	224	104	83	73	127	31	153	138	65	67
6	55	170	241	106	85	70	148	38	141	121	61	74
7	53	175	187	106	83	67	71	39	134	114	57	126
8	51	180	157	134	80	64	70	41	123	103	53	135
9	56	276	140	141	75	64	98	46	115	96	50	140
10	54	313	130	138	73	66	112	49	105	83	60	150
11	59	246	121	131	72	68	63	43	103	85	63	155
12	55	214	113	125	70	73	62	42	105	76	64	155
13	49	203	112	116	71	73	97	55	109	64	53	135
14	44	191	109	110	73	74	83	38	108	48	49	120
15	42	235	104	107	73	88	93	12	111	43	48	115
16	44	249	101	101	73	91	110	22	108	46	48	110
17	63	186	96	95	71	96	57	30	103	50	46	125
18	103	138	94	92	70	142	45	35	102	47	43	120
19	109	130	91	88	70	155	78	39	107	56	40	115
20	109	139	92	88	72	155	96	47	123	92	44	110
21	105	147	91	85	76	146	114	49	149	88	49	100
22	102	149	90	86	76	138	120	48	185	84	53	97
23	95	149	106	89	71	133	117	45	210	78	56	92
24	92	144	112	92	69	128	60	21	230	73	58	90
25	95	140	110	93	67	126	49	31	236	70	56	87
26	90	135	103	98	66	124	68	49	224	67	52	82
27	84	129	112	100	65	121	78	54	228	66	50	87
28	78	195	124	98	63	126	82	53	218	75	52	72
29	79	208	125	95	---	143	79	51	206	72	55	68
30	76	170	121	95	---	139	75	59	204	70	58	66
31	171	---	114	94	---	133	---	117	---	69	53	---
TOTAL	2346	5428	3887	3232	2108	3121	2610	1292	4573	2752	1699	3116
MEAN	75.7	181	125	104	75.3	101	87.0	41.7	152	88.8	54.8	104
MAX	171	313	241	141	98	155	148	117	236	192	70	155
MIN	42	129	90	85	63	60	45	12	102	43	40	66
CFSM	.51	1.22	.85	.70	.51	.68	.59	.28	1.03	.60	.37	.70
IN.	.59	1.36	.98	.81	.53	.78	.66	.32	1.15	.69	.43	.78

CAL YR 1988 TOTAL 33298 MEAN 91.0 MAX 313 MIN 11 CFSM .62 IN 8.37
WTR YR 1989 TOTAL 36164 MEAN 99.1 MAX 313 MIN 12 CFSM .67 IN 9.09

04172000 HURON RIVER NEAR HAMBURG, MI

LOCATION.--Lat 42°27'55", long 83°48'00", in sec.24, T.1 N., R.5 E., Livingston County, Hydrologic Unit 04090005, on right bank at downstream side of bridge on Hamburg Road, 1.1 mi north of Hamburg, and 3 mi upstream from Strawberry Lake.

DRAINAGE AREA.--308 mi².

PERIOD OF RECORD.--October 1951 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 850.00 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Aug. 12, 1953, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 12-14, 17-19, Jan. 9, 10, Feb. 7-26, and Mar. 6-9. Records good except for estimated daily discharges and those for May and June, which are fair. Occasional regulation by Kent Lake (station 04170490), 11 mi upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--38 years, 213 ft³/s, 9.39 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,560 ft³/s, May 15, 1956, gage height, 8.35 ft; maximum gage height, 8.46 ft, June 30, 1968; minimum discharge, 26 ft³/s, July 15, 16, 1988; minimum gage height, 3.16 ft, Aug. 1-3, 1964.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 730 ft³/s, June 27, gage height, 6.98 ft; minimum, 97 ft³/s, Aug. 20; minimum gage height, 3.77 ft, Mar. 2, 3, 4.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	121	198	318	216	218	146	275	226	317	569	152	125
2	124	245	296	206	219	143	263	207	356	518	144	147
3	132	248	275	199	215	142	261	194	380	464	136	159
4	133	241	256	195	206	145	258	191	395	414	130	153
5	128	275	243	191	204	158	276	188	396	374	130	143
6	121	311	256	187	200	160	301	182	382	337	133	138
7	115	328	302	185	195	155	313	177	358	302	129	160
8	112	338	310	222	190	150	283	170	333	276	122	197
9	115	342	281	265	185	150	263	168	316	253	116	232
10	117	383	250	320	180	151	257	168	303	234	117	251
11	116	453	222	307	175	154	254	164	287	213	113	256
12	117	470	210	279	170	162	235	156	273	196	110	258
13	113	458	205	264	170	165	234	159	266	181	111	258
14	107	436	200	248	170	169	241	161	263	165	110	256
15	103	411	190	233	170	191	236	148	269	146	109	249
16	102	400	173	219	165	198	235	132	281	134	107	240
17	118	419	190	208	165	199	243	130	283	126	107	243
18	172	402	185	199	160	250	223	129	282	120	104	240
19	220	361	170	195	160	292	210	128	281	118	100	234
20	243	328	160	193	160	316	213	131	303	130	100	229
21	249	319	157	185	160	316	224	136	330	150	104	222
22	246	314	156	182	155	301	234	136	381	163	105	212
23	234	311	173	179	155	280	235	134	455	166	110	197
24	224	308	192	179	150	266	231	135	570	166	115	180
25	212	301	199	180	150	256	206	157	672	161	116	169
26	202	293	197	187	150	251	200	196	707	154	111	159
27	192	290	200	196	150	247	208	215	725	148	106	148
28	184	283	221	200	148	254	218	217	712	161	103	140
29	175	288	233	200	---	274	224	214	671	167	109	134
30	172	315	236	207	---	283	226	213	620	166	113	129
31	167	---	228	211	---	284	---	259	---	160	113	---
TOTAL	4886	10069	6884	6637	4895	6608	7280	5321	12167	7032	3585	5858
MEAN	158	336	222	214	175	213	243	172	406	227	116	195
MAX	249	470	318	320	219	316	313	259	725	569	152	258
MIN	102	198	156	179	148	142	200	128	263	118	100	125
CFSM	.51	1.09	.72	.70	.57	.69	.79	.56	1.32	.74	.38	.63
IN.	.59	1.22	.83	.80	.59	.80	.88	.64	1.47	.85	.43	.71

CAL YR 1988 TOTAL 70081 MEAN 191 MAX 471 MIN 27 CFSM .62 IN 8.46
WTR YR 1989 TOTAL 81222 MEAN 223 MAX 725 MIN 100 CFSM .72 IN 9.81

04174050 HURON RIVER AT DELHI MILLS, MI

LOCATION.--Lat 42°20'01", long 83°48'34", in SE1/4 sec.2, T.2 S., R.5 E., Washtenaw County, Hydrologic Unit 04090005, at bridge on East Delhi Road, 5.0 mi northwest of Ann Arbor, 5.2 mi downstream from Mill Creek, 5.1 mi upstream from Barton Dam, and 60.0 mi upstream from mouth.

DRAINAGE AREA.--699 mi².

PERIOD OF RECORD.--Water years 1971-81, 1983 to current year.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	SPECIFIC CONDUCTANCE LAB (US/CM)	TEMPERATURE WATER (DEG C)	CARBON, ORGANIC TOTAL (MG/L AS C)	ALDRIN, TOTAL (UG/L)	CHLORDANE, TOTAL (UG/L)	DDD, TOTAL (UG/L)	DDE, TOTAL (UG/L)	DDT, TOTAL (UG/L)	DIAZINON, TOTAL (UG/L)	DIELDRIN TOTAL (UG/L)
OCT											
28...	1415	644	8.0	7.4	<0.01	<0.1	<0.01	<0.01	<0.01	<0.01	<0.01
JAN											
27...	1415	670	2.0	8.1	<0.01	<0.1	<0.01	<0.01	<0.01	<0.01	<0.01
MAR											
10...	1700	685	4.0	7.9	<0.01	<0.1	<0.01	<0.01	<0.01	<0.01	<0.01
MAY											
02...	1030	625	12.0	9.4	<0.01	<0.1	<0.01	<0.01	<0.01	<0.01	<0.01
JUN											
29...	1720	595	22.5	13	<0.01	<0.1	<0.01	<0.01	<0.01	<0.01	<0.01

DATE	ENDOSULFAN, TOTAL (UG/L)	ENDRIN, TOTAL (UG/L)	ETHION, TOTAL (UG/L)	HEPTACHLOR, TOTAL (UG/L)	HEPTACHLOR EPOXIDE TOTAL (UG/L)	LINDANE TOTAL (UG/L)	MALATHION, TOTAL (UG/L)	METHOXYCHLOR, TOTAL (UG/L)	METHYL PARATHION, TOTAL (UG/L)	METHYL TRITHION, TOTAL (UG/L)	MIREX, TOTAL (UG/L)
OCT											
28...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
JAN											
27...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
MAR											
10...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
MAY											
02...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
JUN											
29...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

DATE	NAPHTHALENES, POLYCHLOR. TOTAL (UG/L)	PARATHION, TOTAL (UG/L)	PCB, TOTAL (UG/L)	PERTHANE TOTAL (UG/L)	TOXAPHENE, TOTAL (UG/L)	TOTAL TRITHION (UG/L)	2,4-D, TOTAL (UG/L)	2, 4-DP TOTAL (UG/L)	2,4,5-T TOTAL (UG/L)	SILVEX, TOTAL (UG/L)
OCT										
28...	<0.1	<0.01	<0.1	<0.1	<1	<0.01	0.06	<0.01	<0.01	<0.01
JAN										
27...	<0.1	<0.01	<0.1	<0.1	<1	<0.01	0.02	<0.01	<0.01	<0.01
MAR										
10...	<0.1	<0.01	<0.1	<0.1	<1	<0.01	0.02	<0.01	<0.01	<0.01
MAY										
02...	<0.1	<0.01	<0.1	<0.1	<1	<0.01	0.09	<0.01	<0.01	<0.01
JUN										
29...	<0.1	<0.01	<0.1	<0.1	<1	<0.01	0.12	<0.01	<0.01	<0.01

04174500 HURON RIVER AT ANN ARBOR, MI

LOCATION.--Lat 42°17'10", long 83°44'00", in NW1/4 sec.28, T.2 S., R.6 E., Washtenaw County, Hydrologic Unit 04090005, on left bank 100 ft upstream from bridge on Wall Street in Ann Arbor, 0.7 mi downstream from Argo Dam, and 4.2 mi upstream from Geddes Dam.

DRAINAGE AREA.--729 mi².

PERIOD OF RECORD.--February 1904 to current year. Monthly discharge only for some periods, published in WSP 1307. Published as "at Geddes" February 1904 to December 1914 and as "at Barton" January 1914 to September 1940.

REVISED RECORDS.--WSP 874: 1938. WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 744.81 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). February 1904 to December 1914 at Geddes Dam, 4.2 mi downstream, and January 1914 to September 1947 at Barton Dam, 2.6 mi upstream, flow computed from records of operation of powerplants and records of depth of flow over dam and/or flow through undersluices.

REMARKS.--No estimated daily discharges. Records fair. Diversion upstream from station for Ann Arbor municipal supply had negligible effect on natural flow prior to 1955, figures of runoff adjusted since. Flow regulated by powerplants prior to May 1962. From June 1962 to 1975 occasional regulation for lake level control operations upstream from station. Since 1975 extensive regulation of flow exists due to automation of gates at dams upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--85 years, 459 ft³/s, 8.55 in/yr, adjusted for diversion since 1955.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 5,840 ft³/s, Mar. 14, 1918; minimum daily, 4 ft³/s, Aug. 2, Sept. 11, 1931, plant leakage, but may be doubtful due to change in leakage.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,010 ft³/s, June 1, 24, gage height, 15.39 ft; minimum daily, 131 ft³/s, Aug. 8, 27.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	266	409	640	491	532	305	732	413	1800	981	209	211
2	334	184	615	474	517	301	700	457	1890	983	148	205
3	303	400	618	460	485	301	894	419	1630	776	203	191
4	273	444	589	436	454	324	1100	356	1300	805	206	190
5	255	512	565	423	443	254	1180	338	1080	878	224	197
6	240	1230	538	427	436	210	1120	357	980	582	219	278
7	176	1150	532	527	420	281	970	279	900	535	185	385
8	180	1120	518	1010	406	260	922	282	833	467	131	491
9	201	782	525	823	393	318	887	293	715	451	138	500
10	220	962	526	673	386	321	815	296	678	411	142	438
11	206	1220	500	578	372	330	753	293	640	296	166	377
12	191	1120	455	576	367	348	711	308	609	261	153	322
13	223	1130	461	577	371	349	659	326	516	304	161	379
14	182	1120	437	553	355	351	424	332	519	296	153	416
15	197	1180	407	537	369	410	457	329	689	315	175	449
16	214	1100	390	512	362	447	555	327	803	287	188	468
17	298	1010	380	489	352	445	662	313	711	255	162	496
18	431	926	372	469	345	688	690	279	606	191	146	472
19	483	908	354	463	340	705	689	292	633	213	138	380
20	440	1020	353	456	343	687	624	323	779	247	169	371
21	432	1090	272	438	347	703	487	305	1150	224	157	366
22	445	997	313	420	335	830	433	292	1310	192	151	370
23	509	898	440	408	317	722	452	287	1310	201	149	373
24	559	839	491	401	318	646	506	271	1210	213	142	312
25	459	729	465	403	330	558	547	453	1330	416	140	299
26	275	734	454	450	328	577	589	623	1310	340	140	249
27	309	701	557	448	316	603	460	557	1530	321	131	239
28	433	700	674	431	316	710	389	511	1410	391	188	236
29	413	668	612	463	---	872	400	398	1330	250	208	242
30	396	628	530	512	---	900	403	421	1160	281	223	235
31	396	---	515	521	---	810	---	987	---	234	140	---
TOTAL	9939	25911	15098	15849	10655	15566	20210	11717	31361	12597	5185	10137
MEAN	321	864	487	511	381	502	674	378	1045	406	167	338
MAX	559	1230	674	1010	532	900	1180	987	1890	983	224	500
MIN	176	184	272	401	316	210	389	271	516	191	131	190
MEAN+	341	882	503	526	396	518	692	397	1066	431	189	359
CFSM+	.47	1.21	.69	.72	.54	.71	.95	.54	1.46	.59	.26	.49
IN.+	.54	1.35	.80	.83	.57	.82	1.06	.63	1.63	.68	.30	.55

CAL YR 1988 TOTAL 157046 MEAN 429 MAX 1530 MIN 18 MEAN+ 452 CFSM+ .62 IN+ 8.44
WTR YR 1989 TOTAL 184225 MEAN 505 MAX 1890 MIN 131 MEAN+ 524 CFSM+ .72 IN+ 9.75

+ Adjusted for diversion for municipal supply; record furnished by City of Ann Arbor.

04174950 WILLOW RUN NEAR RAWSONVILLE, MI

LOCATION.--Lat 42°13'09", long 83°32'13", in SW1/4 sec.18, T.3 S., R.8 E., Wayne County, Hydrologic Unit 04090005, on right bank 30 ft upstream from culverts on North I-94 Service Road, 0.7 mi upstream from mouth, and 0.8 mi northeast of Rawsonville.

DRAINAGE AREA.--Indeterminate.

PERIOD OF RECORD.--April 1986 to current year (seasonal records only, April to September).

GAGE.--Water-stage recorder. Elevation of gage is 670 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--No estimated daily discharges. Records good. Actual surface drainage area is 6.28 mi². Flow contains effluent from sewage-treatment plant about 1 mi upstream from station. Some of this flow originates from ground-water sources and other sources outside the basin. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge during period April to September, 127 ft³/s, May 31, 1989; minimum daily, 21 ft³/s, Aug. 31, Sept. 1, 18, 1986, July 5, 1987, July 5, 1989.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1							28	24	87	27	31	48
2							28	25	59	26	30	30
3							54	28	61	28	29	27
4							42	27	49	27	42	27
5							38	27	41	21	35	26
6							33	29	38	33	31	28
7							32	26	32	29	28	47
8							29	25	36	25	28	37
9							28	30	45	25	30	56
10							28	28	31	30	27	41
11							29	27	29	26	31	29
12							26	28	34	30	30	30
13							25	30	36	24	28	31
14							29	24	30	25	26	36
15							27	29	37	26	33	34
16							24	29	34	24	31	42
17							40	27	29	26	27	41
18							37	27	32	29	29	34
19							34	26	56	29	27	31
20							32	29	44	58	30	32
21							31	28	37	32	29	32
22							28	26	37	28	33	33
23							26	26	36	31	30	28
24							27	28	31	25	28	25
25							32	56	31	36	28	28
26							30	43	29	42	29	27
27							26	31	36	43	23	28
28							28	27	28	44	33	28
29							25	29	33	30	40	27
30							24	37	30	30	30	28
31							---	127	---	29	29	---
TOTAL							920	1003	1168	938	935	991
MEAN							30.7	32.4	38.9	30.3	30.2	33.0
MAX							54	127	87	58	42	56
MIN							24	24	28	21	23	25

04175600 RIVER RAISIN NEAR MANCHESTER, MI

LOCATION.--Lat 42°10'05", long 84°04'34", in NE1/4 SE1/4 sec.33, T.3 S., R.3 E., Washtenaw County, Hydrologic Unit 04100002, on left bank at downstream side of bridge on Sharon Valley Road, and 2.5 mi northwest of Manchester.

DRAINAGE AREA.--132 mi^2.

PERIOD OF RECORD.--January 1970 to September 1981, January 1985 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 900 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to July 30, 1970, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 11-13, 17, Dec. 29 to Jan. 14, Jan. 19-21, and Feb. 5 to Mar. 8. Records good except for estimated daily discharges, which are fair. Occasional regulation caused by many dams upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--15 years (water years 1971-81, 1986-89), 103 ft^3/s, 10.60 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 869 ft^3/s, Feb. 24, 1985, gage height, 7.21 ft; minimum, 4.5 ft^3/s, Nov. 29, 1971; minimum gage height, 1.16 ft, Oct. 12, Nov. 4, 1978.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 280 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Mar. 30	0700	293	4.75	Apr. 9	1500	283	4.69
Apr. 5	0800	356	5.11	May. 31	2300	*646	*6.77

Minimum discharge, 26 ft^3/s, Oct. 11, gage height, 1.75 ft; minimum daily, 33 ft^3/s, Oct. 15.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	51	64	153	120	152	68	239	107	612	95	95	72
2	59	64	145	115	142	67	216	101	535	87	84	109
3	68	62	142	108	131	66	262	105	473	82	75	98
4	64	63	133	105	120	68	328	103	439	79	73	87
5	57	95	129	102	115	100	352	102	389	75	88	79
6	54	149	124	100	110	95	328	98	351	72	87	73
7	46	155	122	105	105	87	296	95	314	69	77	110
8	43	152	115	190	100	82	274	93	291	63	69	120
9	41	147	109	195	97	77	277	89	262	59	61	109
10	42	205	105	190	94	79	268	88	237	56	55	102
11	40	239	100	170	91	88	250	83	213	52	51	92
12	37	203	98	150	88	102	239	79	196	54	47	83
13	41	201	96	140	85	99	225	93	194	52	45	76
14	36	195	92	135	84	103	210	99	193	49	45	85
15	33	172	90	128	83	141	202	97	204	45	46	100
16	35	175	87	122	82	134	190	93	212	43	51	104
17	52	206	85	119	80	127	188	87	209	41	52	147
18	116	179	83	115	77	188	213	82	198	39	48	133
19	130	169	79	112	73	202	205	81	197	39	44	109
20	110	179	80	108	73	187	189	89	260	52	46	94
21	99	224	90	105	73	175	174	89	232	73	51	87
22	97	211	83	102	72	165	165	81	196	90	48	80
23	94	195	117	98	71	158	153	74	174	90	48	77
24	98	179	135	97	70	153	145	69	157	82	45	68
25	100	168	126	97	71	155	141	158	140	76	43	61
26	91	163	124	117	72	157	142	244	130	88	40	60
27	83	173	119	119	70	159	136	174	122	101	38	55
28	81	179	161	112	68	172	130	140	118	103	39	48
29	78	167	170	123	---	256	121	113	110	91	55	47
30	69	160	155	146	---	290	116	113	103	91	54	44
31	64	---	140	147	---	270	---	462	---	106	48	---
TOTAL	2109	4893	3587	3892	2549	4270	6374	3581	7461	2194	1748	2609
MEAN	68.0	163	116	126	91.0	138	212	116	249	70.8	56.4	87.0
MAX	130	239	170	195	152	290	352	462	612	106	95	147
MIN	33	62	79	97	68	66	116	69	103	39	38	44
CFSM	.52	1.24	.88	.96	.69	1.05	1.61	.88	1.89	.54	.43	.66
IN.	.59	1.38	1.01	1.10	.72	1.20	1.80	1.01	2.10	.62	.49	.74

CAL YR 1988 TOTAL 31880.5 MEAN 87.1 MAX 305 MIN 5.7 CFSM .66 IN 8.98
WTR YR 1989 TOTAL 45267.0 MEAN 124 MAX 612 MIN 33 CFSM .94 IN 12.76

04176000 RIVER RAISIN NEAR ADRIAN, MI

LOCATION.--Lat 41°54'15", long 83°58'50", in NW1/4 sec.5, T.7 S., R.4 E., Lenawee County, Hydrologic Unit 04100002, on right bank at downstream side of bridge on Academy Road, 1.7 mi east of Adrian, and 2.6 mi downstream from South Branch.

DRAINAGE AREA.--463 mi^2.

PERIOD OF RECORD.--October 1953 to September 1978, October 1978 to September 1984 (operated as a crest-stage partial-record station only), October 1984 to current year. Records for October 1930 to August 1931 and October 1932 to April 1938, published as "Raisin River" in WSP 714, 744, 759, 784, 804, 824, and 854, have been found to be unreliable and should not be used.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 693.2 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 11-20, Jan. 1-12, 19-23, and Feb. 7 to Mar. 13. Records good except for estimated daily discharges, which are fair. Diurnal fluctuation caused by powerplant at Tecumseh, 11 mi upstream from station, prior to June 27, 1968. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--30 years (water years 1954-78, 1985-89), 325 ft^3/s, 9.53 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,660 ft^3/s, Mar. 15, 1982, gage height, 15.77 ft; minimum, 18 ft^3/s, Aug. 10, 1964, gage height, 1.33 ft; minimum daily, 25 ft^3/s, Oct. 26, 1965.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,400 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
June 1	2300	*2,990	*12.96	No other peak greater than base discharge.			

Minimum discharge, 96 ft^3/s, Oct. 14; minimum gage height, 2.95 ft, Sept. 28, result of regulation.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	123	194	415	450	692	205	777	336	2550	326	266	290
2	171	187	392	370	667	200	668	321	2860	320	249	283
3	160	147	387	320	555	200	804	309	2460	379	227	249
4	155	173	371	310	432	210	1130	303	2120	299	209	246
5	150	300	351	310	390	260	1350	305	2010	270	207	231
6	136	518	342	310	367	350	1220	301	1620	249	208	209
7	123	728	332	310	340	310	1000	300	1200	238	205	267
8	116	723	319	700	333	290	846	286	1010	223	194	252
9	109	618	298	900	320	250	789	281	848	210	182	255
10	105	698	282	1000	310	250	741	253	768	200	180	324
11	104	929	250	950	300	270	691	240	703	187	166	308
12	104	1060	230	900	290	280	636	252	631	181	162	291
13	101	912	230	717	285	300	562	279	620	184	150	249
14	97	798	260	609	280	333	570	281	617	181	141	255
15	99	693	250	492	280	393	551	284	635	168	147	293
16	101	580	240	437	275	513	522	275	636	160	158	334
17	167	514	230	391	270	458	507	248	588	154	145	472
18	376	485	220	376	265	654	533	252	567	148	143	458
19	509	456	220	370	260	909	540	246	618	156	140	396
20	496	475	220	360	255	893	547	267	1080	239	149	332
21	365	779	235	350	250	701	508	268	1120	245	147	290
22	309	1050	233	340	245	606	474	258	1170	245	152	268
23	280	976	309	330	240	541	447	242	965	284	175	221
24	287	689	465	318	235	511	418	224	722	270	171	218
25	301	560	510	313	225	509	423	420	590	244	137	210
26	310	495	424	423	215	525	441	745	511	271	123	199
27	273	485	387	608	210	536	432	839	425	272	121	181
28	248	508	642	514	210	557	403	693	381	277	136	129
29	228	482	759	488	---	678	378	448	362	296	193	144
30	216	443	709	693	---	912	358	380	350	270	145	147
31	205	---	518	745	---	909	---	1020	---	272	149	---
TOTAL	6524	17655	11030	15704	8996	14513	19266	11156	30746	7418	5277	8001
MEAN	210	589	356	507	321	468	642	360	1025	239	170	267
MAX	509	1060	759	1000	692	912	1350	1020	2860	379	266	472
MIN	97	147	220	310	210	200	358	224	350	148	121	129
CFSM	.45	1.27	.77	1.10	.69	1.01	1.39	.78	2.21	.52	.37	.58
IN.	.52	1.42	.89	1.26	.72	1.17	1.55	.90	2.47	.60	.42	.64

CAL YR 1988 TOTAL 118422 MEAN 324 MAX 2500 MIN 34 CFSM .70 IN 9.51
WTR YR 1989 TOTAL 156286 MEAN 428 MAX 2860 MIN 97 CFSM .92 IN 12.56

04176500 RIVER RAISIN NEAR MONROE, MI
(National stream quality accounting network station)

LOCATION.--Lat 41°57'38", long 83°31'52", Monroe County, Hydrologic Unit 04100002, on left bank 0.8 mi downstream from bridge on Ida Maybee Road, 5.0 mi downstream from Saline River, and 7.5 mi west of Monroe.

DRAINAGE AREA.--1,042 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--September 1937 to current year. Published as "Raisin River at Monroe" 1937-52 and as "River Raisin at Monroe" 1952-53.

REVISED RECORDS.--WSP 954: 1938-40(M), 1941. WSP 1437: 1939, 1948. WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 616.26 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 1, 1953, at site 9 mi downstream at datum 46.26 ft lower.

REMARKS.--Estimated daily discharges: Dec. 11-19, Dec. 26 to Jan. 14, Jan. 20-23, Feb. 5-13, 16-19, and Feb. 22 to Mar. 10. Water-discharge records good except for estimated daily discharges, which are fair. Diurnal fluctuation caused by powerplants upstream from station prior to June 27, 1968. At times, flow is affected by irrigation pumpage.

AVERAGE DISCHARGE.--52 years, 730 ft³/s, 9.51 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 15,300 ft³/s, Mar. 16, 1982, gage height, 10.4 ft; maximum gage height, 11.16 ft, Mar. 15, 1982, backwater from ice; minimum discharge, about 2 ft³/s, Sept. 4, 1938, Sept. 19, 20, 1941, site then in use.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 3,500 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
June 4	1300	*8,260	*8.97	No other peak greater than base discharge.			

Minimum discharge, 143 ft³/s, Oct. 16, gage height, 2.21 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	209	291	781	1050	1970	340	1470	562	6360	533	537	283
2	223	278	710	830	1780	320	1300	533	6720	493	456	347
3	218	266	652	700	1430	310	1590	505	6160	540	406	401
4	235	254	603	600	1150	295	2260	484	8010	650	370	368
5	241	291	574	530	860	390	2540	473	7670	569	350	317
6	222	795	557	530	650	450	2550	464	6660	465	338	297
7	211	1100	531	560	620	550	2390	466	5010	411	306	321
8	201	1370	511	1300	600	490	2120	456	3680	370	286	360
9	183	1420	485	1650	570	470	1890	451	2740	339	276	388
10	172	1520	460	1900	550	460	1610	433	1980	314	266	411
11	166	1860	400	2000	530	441	1400	413	1450	293	253	447
12	161	1800	330	1900	510	426	1220	386	1180	279	284	448
13	152	1970	330	1750	515	436	1100	390	1040	266	291	407
14	146	1950	350	1600	502	467	962	409	957	253	250	381
15	151	1700	400	1180	489	496	883	424	942	244	224	414
16	147	1480	450	947	500	586	851	424	964	238	206	453
17	152	1220	420	823	480	627	824	410	941	225	204	886
18	259	996	380	734	470	1080	848	378	893	210	208	934
19	495	857	340	687	450	1300	1030	355	1070	220	194	811
20	734	831	332	690	434	1470	1080	360	2790	637	196	670
21	815	1660	343	660	428	1490	1030	357	2790	708	197	560
22	681	1780	367	620	430	1340	917	366	2650	681	208	473
23	525	1960	361	590	420	1120	808	361	2480	656	207	399
24	444	1840	511	563	390	998	732	346	2150	600	201	360
25	421	1530	753	549	370	938	692	526	1670	493	210	319
26	423	1190	840	617	370	906	685	1260	1200	1200	219	294
27	419	991	840	883	380	893	724	1500	922	994	197	277
28	404	904	1300	1100	360	903	719	1600	774	828	181	263
29	369	867	1600	1180	---	1140	666	1300	656	678	193	248
30	327	845	1500	1540	---	1390	610	966	583	595	197	215
31	301	---	1300	1790	---	1510	---	2740	---	639	233	---
TOTAL	9807	35816	19311	32053	18208	24032	37501	20098	83092	15621	8144	12752
MEAN	316	1194	623	1034	650	775	1250	648	2770	504	263	425
MAX	815	1970	1600	2000	1970	1510	2550	2740	8010	1200	537	934
MIN	146	254	330	530	360	295	610	346	583	210	181	215
CFSM	.30	1.15	.60	.99	.62	.74	1.20	.62	2.66	.48	.25	.41
IN.	.35	1.28	.69	1.14	.65	.86	1.34	.72	2.97	.56	.29	.46

CAL YR 1988 TOTAL 213566 MEAN 584 MAX 2970 MIN 28 CFSM .56 IN 7.62
WTR YR 1989 TOTAL 316435 MEAN 867 MAX 8010 MIN 146 CFSM .83 IN 11.30

04176500 RIVER RAISIN NEAR MONROE, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1966-75, 1978 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: April 1978 to July 1981.
WATER TEMPERATURE: March 1966 to September 1972, April 1978 to July 1981.
SUSPENDED-SEDIMENT DISCHARGE: March 1966 to September 1972.

INSTRUMENTATION.--Water-quality monitor from Mar. 23 to July 13, 1981.

REMARKS.--Cross-sectional samples were collected at gaging station, or 0.8 mi upstream from gage at bridge on Ida Maybee Road.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1979-81): Maximum daily, 1,020 microsiemens, Feb. 16, 1979; minimum daily recorded (more than 20 percent missing record), 263 microsiemens, Jan. 25, 1981.
WATER TEMPERATURE (water years 1967, 1970-72, 1979-80): Maximum daiy recorded (more than 20 percent missing record), 32.0°C, July 18, 1972; minimum daily, 0.0°C on many days during winter.
SEDIMENT CONCENTRATION (water years 1967-72): Maximum daily mean, 1,430 mg/L, Dec. 22, 1967; minimum daily mean, 1 mg/L on several days in 1970.
SEDIMENT LOAD: Maximum daily, 28,000 tons, Dec. 22, 1967; minimum daily, 0.29 ton, Aug. 31, 1971.

EXTREMES OUTSIDE PERIOD OF DAILY RECORD.--A specific conductance of 200 microsiemens was measured Feb. 25, 1985.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
DEC										
21...	1630	340	821	8.3	0.5	3.3	14.1	99	270	230
MAR										
10...	1230	471	683	8.4	1.0	13	17.4	124	K36	210
MAY										
02...	1430	531	723	8.7	13.0	--	10.6	104	--	--
JUN										
29...	1100	656	657	8.3	22.0	31	9.0	104	E230	E280
SEP										
20...	1330	662	725	8.3	17.0	32	9.4	99	K100	K600

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
DEC										
21...	390	140	110	27	25	12	0.6	12	303	0
MAR										
10...	310	130	91	21	26	15	0.7	11	210	7
MAY										
02...	--	--	--	--	--	--	--	--	--	--
JUN										
29...	320	90	96	19	13	8	0.3	6.4	278	0
SEP										
20...	340	110	99	22	18	10	0.4	8.8	276	0

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)
DEC									
21...	248	140	46	0.2	7.8	524	0.71	481	0.03
MAR									
10...	184	110	43	0.3	4.9	434	0.59	552	--
MAY									
02...	--	--	--	--	--	--	--	--	0.04
JUN									
29...	228	69	29	0.2	9.0	422	0.57	747	0.03
SEP									
20...	226	87	32	0.2	11	435	0.59	778	0.03

04176500 RIVER RAISIN NEAR MONROE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)
DEC 21...	2.9	0.14	0.13	0.70	0.04	0.02	0.01	10	<1	67
MAR 10...	--	--	--	--	--	--	--	<10	<1	59
MAY 02...	2.8	0.04	0.04	1.3	0.07	0.02	<0.01	--	--	--
JUN 29...	3.6	0.03	0.04	0.70	0.07	0.04	0.05	10	1	55
SEP 20...	2.4	0.06	0.03	0.80	0.13	0.05	0.05	20	1	67

DATE	BERYLLIUM, DISSOLVED (UG/L AS BE)	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)
DEC 21...	<0.5	<1	<1	<3	4	11	<5	16	32	<0.1
MAR 10...	<0.5	<1	<1	<3	2	30	<5	11	33	<0.1
MAY 02...	--	--	--	--	--	--	--	--	--	--
JUN 29...	<0.5	<1	1	<3	3	11	<1	10	13	<0.1
SEP 20...	<0.5	<1	<1	<3	2	<3	<1	9	9	<0.1

DATE	MOLYBDENUM, DISSOLVED (UG/L AS MO)	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DIS SOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
DEC 21...	10	6	<1	<1.0	750	<6	9	18	17	--
MAR 10...	10	5	<1	<1.0	620	<6	7	15	19	89
MAY 02...	--	--	--	--	--	--	--	--	--	--
JUN 29...	<10	2	<1	<1.0	430	<6	9	49	87	98
SEP 20...	<10	1	<1	<1.0	530	<6	4	84	150	74

04176605 OTTER CREEK AT LA SALLE, MI

LOCATION.--Lat 41°52'01", long 83°27'13", in NW1/4 NW1/4 sec.23 (private claim 47), T.7 S., R.8 E., Monroe County, Hydrologic Unit 04100001, on right bank 150 ft upstream from bridge on State Highway 125 in La Salle, 2.3 mi downstream from South Branch, and 4.6 mi southwest of Monroe.

DRAINAGE AREA.--51.0 mi^2.

PERIOD OF RECORD.--October 1987 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 580 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 10-20, Dec. 23 to Jan. 17, Jan. 19-23, and Feb. 4 to Mar. 8. Records fair except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD--Maximum discharge, 775 ft^3/s, June 4, 1989, gage height, 8.87 ft; maximum gage height, 9.17 ft, Feb. 23, 1988, backwater from ice; no flow June 21 to July 16, 1988.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 400 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
May 31	1500	695	8.67	June 20	0800	487	8.19
June 4	0200	*775	*8.87	July 20	2300	519	8.27

Minimum discharge, 0.13 ft^3/s, Oct. 16, gage height, 5.41 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.34	1.0	19	30	74	7.9	41	21	510	15	42	7.9
2	.75	.96	17	22	53	7.6	34	20	391	13	29	16
3	.91	1.1	16	19	38	7.5	174	19	359	12	22	9.4
4	1.8	.98	15	17	26	8.0	217	18	579	11	19	6.3
5	1.2	35	13	16	20	9.5	148	20	263	10	18	4.8
6	.67	89	13	20	15	11	96	20	156	9.1	15	4.1
7	.40	49	12	25	13	15	71	26	105	8.0	11	8.3
8	.30	33	11	135	12	11	58	27	73	6.8	9.2	18
9	.28	25	9.8	80	11	9.4	54	25	54	6.1	7.9	14
10	.25	58	9.5	60	10	8.9	44	24	42	5.5	6.9	16
11	.26	66	8.5	38	9.8	9.9	37	22	32	4.7	6.2	15
12	.20	37	7.5	33	9.6	11	35	21	29	4.3	5.6	10
13	.18	46	8.0	29	10	10	42	27	39	4.1	5.2	8.0
14	.19	55	8.2	26	13	13	39	34	53	4.1	4.6	7.7
15	.18	37	8.0	23	15	18	42	31	55	3.5	4.2	12
16	.17	27	7.6	20	13	17	47	29	50	3.0	4.0	14
17	.49	20	7.5	20	11	16	41	25	41	2.7	3.7	37
18	22	15	7.7	20	10	35	69	20	64	2.4	3.3	34
19	12	12	8.5	20	9.8	44	69	18	82	2.5	2.8	22
20	5.1	28	9.0	20	9.6	37	54	19	408	199	3.8	16
21	3.4	159	10	19	11	38	44	21	234	353	4.7	13
22	2.8	108	9.0	19	14	37	37	18	181	151	4.0	11
23	2.5	69	23	18	12	35	32	16	145	88	3.5	9.9
24	2.9	50	35	18	10	34	28	14	93	54	3.0	8.1
25	3.0	39	55	18	9.5	33	29	29	61	41	2.7	7.1
26	2.8	33	40	64	9.0	32	35	112	42	259	2.2	6.6
27	2.4	33	60	83	8.5	29	32	82	33	153	1.9	6.1
28	1.7	31	110	60	8.1	35	29	43	27	103	1.8	5.3
29	1.4	25	80	93	---	69	26	30	21	67	2.3	5.1
30	1.3	22	60	138	---	64	23	27	17	52	2.5	4.8
31	1.3	---	45	102	---	54	---	499	---	61	2.1	---
TOTAL	73.17	1205.04	742.8	1305	464.9	766.7	1727	1357	4239	1708.8	254.1	357.5
MEAN	2.36	40.2	24.0	42.1	16.6	24.7	57.6	43.8	141	55.1	8.20	11.9
MAX	22	159	110	138	74	69	217	499	579	353	42	37
MIN	.17	.96	7.5	16	8.1	7.5	23	14	17	2.4	1.8	4.1
CFSM	.05	.79	.47	.83	.33	.48	1.13	.86	2.77	1.08	.16	.23
IN.	.05	.88	.54	.95	.34	.56	1.26	.99	3.09	1.25	.19	.26

CAL YR 1988 TOTAL 7914.71 MEAN 21.6 MAX 236 MIN .00 CFSM .42 IN 5.77
WTR YR 1989 TOTAL 14201.01 MEAN 38.9 MAX 579 MIN .17 CFSM .76 IN 10.36

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

As the number of streams on which streamflow information is likely to be desired far exceeds the number of stream-gaging stations feasible to operate at one time, the Geological Survey collects limited streamflow data at sites other than stream-gaging stations. When limited streamflow data are collected on a systematic basis over a period of years for use in hydrologic analyses, the site at which the data are collected is called a partial-record station. Data collected at these partial-record stations are usable in low-flow or floodflow analyses, depending on the type of data collected. In addition, discharge measurements are made at other sites not included in the partial-record program. These measurements are generally made in time of drought or flood to give better areal coverage to those events. Those measurements and others collected for some special reason are called measurements at miscellaneous sites.

Records collected at partial-record stations are presented in two tables. The first is a table of annual maximum stage and discharge at crest-stage partial-record stations and the second is a table of discharge measurements at low-flow partial-record stations. Discharge measurements at miscellaneous sites are given in a third table.

Crest-stage partial-record stations

The following table contains annual maximum discharge for crest-stage stations. A crest-stage gage is a device which will register the peak stage occurring between inspections of the gage. A stage-discharge relation for each gage is developed from discharge measurements made by indirect measurements of peak flow or by current meter. The date of the maximum discharge is not always certain but is usually determined by comparison with nearby continuous-record stations, weather records, or local inquiry. Only the maximum discharge for each water year is given. Information on some lower floods may have been obtained but is not published herein. The years given in the period of record represent water years for which the annual maximum has been determined.

Annual maximum discharge at crest-stage partial-record stations during water year 1989

Station No.	Station Name	Location	Drainage area (mi^2)	Period of record	Annual Maximum Date	Annual Maximum Gage height (ft)	Annual Maximum Discharge (ft^3/s)
		STREAMS TRIBUTARY TO LAKE SUPERIOR					
04041000	Perch River near Sidnaw, MI	Lat 46°31'06", long 88°39'48", in NE1/4 sec:34, T.48 N., R.35 W., Baraga County, Hydrologic Unit 04020104, at State Highway 28, 2.5 mi east of Sidnaw.	63.1	1913-15‡, 1957-89	06-09-89	a9.43	410
04044200	Carp Creek at Ishpeming, MI	Lat 46°29'11", long 87°41'21", in NW1/4 sec.9, T.47 N., R.27 W., Marquette County, Hydrologic Unit 04020105, at Highway 41A in Ishpeming.	16.5	1970-89	06-09-89	6.66	183
04044813	Two Hearted River near Paradise, MI	Lat 46°41'15", long 85°26'26", in SE1/4 NW1/4 sec.33, T.50 N., R.9 W., Luce County, Hydrologic Unit 04020201, on right bank, 300 ft downstream from end of Trail Road, 3.2 mi upstream from mouth, and 20 mi northwest of Paradise.	200	1973-89	04-26-89	9.31	903
04045538	West Branch Waiska River near Brimley, MI	Lat 46°21'18", long 84°35'35", in SW1/4 NW1/4 sec.29, T.46 N., R.2 W., Chippewa County, Hydrologic Unit 04020203, at county road, 3.2 mi upstream from mouth, and 3.5 mi south of Brimley.	40.7	1973-89	11-06-88	8.59	738
04045559	East Branch Waiska River near Brimley, MI	Lat 46°25'07", long 84°28'24", in NW1/4 NE1/4 sec.6, T.46 N., R.1 W., Chippewa County, Hydrologic Unit 04020203, at county road, 4.0 mi upstream from mouth, and 4.7 mi east of Brimley.	30.1	1973-89	04-05-89	b11.25	c400
		STREAMS TRIBUTARY TO LAKE MICHIGAN					
04046000	Black River near Garnet, MI	Lat 46°07'05", long 85°21'55", in SE1/4 sec.13, T.43 N., R.9 W., Mackinac County, Hydrologic Unit 04060107, on right bank 10 ft upstream from footbridge, 15 ft downstream from Peters Creek, 3.5 mi upstream from mouth, and 4 mi southwest of Garnet.	d28	1951-78‡, 1979-89	11-06-88	4.80	182
04057900	Black River near Republic, MI	Lat 42°25'08", long 87°53'21", in NE1/4 sec.2, T.46 N., R.29 W., Marquette County, Hydrologic Unit 04030110, at county road, 4.4 mi east of Republic.	34.4	1961-68‡, 1970-89	06-09-89	4.25	376
04059400	Tenmile Creek at Perronville, MI	Lat 45°48'38", long 87°22'00", in NW1/4 NW1/4 sec.2, T.39 N., R.25 W., Menominee County, Hydrologic Unit 04030109, at county road, 1 mi northwest of Perronvilie, and 11.5 mi upstream from Ford River.	38.4	1971-77‡, 1978-89	04-05-89	e4.62	c350

See footnotes at end of table.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Annual maximum discharge at crest-stage partial-record stations during water year 1989--Continued

					Annual Maximum		
Station No.	Station Name	Location	Drainage area (mi²)	Period of record	Date	Gage height (ft)	Discharge (ft³/s)
		STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued					
04062300	Michigamme River at Republic, MI	Lat 46°23'03", long 87°58'48", in SE1/4 sec.18, T.46 N., R.29 W., Marquette County, Hydrologic Unit 04030107, on left bank 400 ft upstream from county highway, 0.3 mi upstream from Trout Falls Creek, and 0.6 mi south of Republic.	240	1961-75†, 1976-89	04-30-89	5.03	1,760
04096272	Beebe Creek near Hillsdale, MI	Lat 41°57'15", long 84°38'20", in NE1/4 NE1/4 sec.15, T.6 S., R.3 W., Hillsdale County, Hydrologic Unit 04050001, at Moore Road, 1.2 mi northwest of Hillsdale.	42.4	1974-78†, 1979-89	06-01-89	7.07	494
04096340	St. Joseph River at Clarendon, MI	Lat 42°07'51", long 84°51'56", in SW1/4 SW1/4 sec.11, T.4 S., R.5 W., Calhoun County, Hydrologic Unit 04050001, at 22 Mile Road in Clarendon.	144	1974-77†, 1978-89	06-04-89	8.02	1,000
04097170	Portage River near Vicksburg, MI	Lat 42°06'53", long 85°29'08", in SW1/4 sec.16, T.4 S., R.10 W., Kalamazoo County, Hydrologic Unit 04050001, at W Avenue, 2.4 mi east of Vicksburg.	68.2	1946-51†, 1965-80†, 1980-89	06-02-89	f5.81	416
04108645	Rabbit River at Hamilton, MI	Lat 42°40'31", long 86°00'13", in NE1/4 sec.6, T.3 N., R.14 W., Allegan County, Hydrologic Unit 04050003, at State Highway 40 in Hamilton.	274	1979-89	06-01-89	18.20	5,260
04112700	Sycamore Creek near Mason, MI	Lat 42°36'38", long 84°27'58", in NE1/4 NE1/4 sec.31, T.3 N., R.1 W., Ingham County, Hydrologic Unit 04050004, at Harper Road, 0.7 mi downstream from Aurelius and Vevay Drain, and 2.6 mi northwest of Mason.	39.5	1975-89	06-01-89	10.25	384
04113090	Carrier Creek near Grand Ledge, MI	Lat 42°43'36", long 84°39'16", in SE1/4 SW1/4 sec.15, T.4 N., R.3 W., Eaton County, Hydrologic Unit 04050004, at St. Joe Highway, 3.7 mi upstream from mouth, and 4.0 mi southeast of Grand Ledge.	7.18	1975-89	05-31-89	7.71	230
04117000	Quaker Brook near Nashville, MI	Lat 42°33'57", long 85°05'37", in NW1/4 sec. 13, T.2 N., R.7 W., Barry County, Hydrologic Unit 04050007, on left bank 150 ft upstream from culvert on county road, 500 ft upstream from small tributary, and 2.5 mi south of Nashville.	7.60	1954-75†, 1976-89	05-31-89	6.49	200
04119055	Plaster Creek at Grand Rapids, MI	Lat 42°54'46", long 85°39'02", in SE1/4 sec.7, T.6 N., R.11 W., Kent County, Hydrologic Unit 04050006, at 28th Street in Grand Rapids.	46.6	1974-89	10-25-88	8.74	800
04119160	Buck Creek at Grandville, MI	Lat 42°54'09", long 85°45'46", in SE1/4 sec.18, T.6 N., R.12 W., Kent county, Hydrologic Unit 04050006, at Wilson Avenue in Grandville.	50.5	1974-89	10-25-88	8.09	642
*04120295	Black Creek near Muskegon, MI	Lat 43°12'14", long 86°09'52", in NE1/4 NW1/4 sec.1, T.9 N., R.16 W., Muskegon County, Hydrologic Unit 04060101, at Mill Iron Road, 4.8 mi east of Muskegon, and 4.9 mi upstream from mouth.	d39	1975, 1977, 1979-89	05-31-89	3.17	229
04122230	North Branch Pentwater River near Pentwater, MI	Lat 43°47'42", long 86°21'30", in NE1/4 SE1/4 sec.8, T.16 N., R.17 W., Oceana County, Hydrologic Unit 04060101, at Oceana Drive, 3.5 mi northeast of Pentwater.	42.3	1975-89	05-31-89	3.57	316
04124500	East Branch Pine River near Tustin, MI	Lat 44°06'09", long 85°31'02", in NE1/4 NW1/4 sec.28, T.20 N., R.10 W., Osceola County, Hydrologic Unit 04060103, at Marion Road, 3.0 mi west of Tustin.	60.0	1952-63†, 1964-89	03-29-89	6.11	644

See footnotes at end of table.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Annual maximum discharge at crest-stage partial-record stations during water year 1989--Continued

Station No.	Station Name	Location	Drainage area (mi²)	Period of record	Annual Maximum		
					Date	Gage height (ft)	Discharge (ft³/s)
STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued							
04126600	Betsie River near Benzonia, MI	Lat 44°36'02", long 86°05'57", in NW1/4 NW1/4 sec.2, T.25 N., R.15 W., Benzie County, Hydrologic Unit 04060104, at U.S. Highway 31, 1.2 mi south of Benzonia.	d170	1975-89	03-28-89	5.46	993
04127850	Boyne River near Boyne City, MI	Lat 45°11'48", long 84°57'26", in NW1/4 SW1/4 sec.5, T.32 N., R.5 W., Charlevoix County, Hydrologic Unit 04060105, at Dam Road, 0.3 mi downstream from Boyne River hydroelectric plant, and 2.8 mi southeast of Boyne City.	64.2	1975-89	03-28-89	4.12	417
STREAMS TRIBUTARY TO LAKE HURON							
04139000	Houghton Creek near Lupton, MI	Lat 44°23'45", long 84°02'50", in SE1/4 SE1/4 sec.10, T.23 N., R.3 E., Ogemaw County, Hydrologic Unit 04080101, 2.7 mi southwest of Lupton.	29.7	1950-73†, 1973-89	03-27-89	6.36	558
04140200	Klacking Creek near Selkirk, MI	Lat 44°20'05", long 84°08'46", in NE1/4 NE1/4 sec.2, T.22 N., R.2 E., Ogemaw County, Hydrologic Unit 04080101, at Campbell Road, 4.0 mi northwest of Selkirk.	7.51	1953-89	03-27-89	2.24	109
04140500	Rifle River at Selkirk, MI	Lat 44°18'48", long 84°04'10", in SE1/4 NE1/4 sec.9, T.22 N., R.3 E., Ogemaw County, Hydrologic Unit 04080101, at State Road in Selkirk.	117	1950-82†, 1983-89	03-27-89	5.17	2,160
04141100	Shepards Creek near Selkirk, MI	Lat 44°18'27", long 84°05'05", in SE1/4 SE1/4 sec.8, T.22 N., R.3 E., Ogemaw County, Hydrologic Unit 04080101, at Bedtelyon Road, 1.1 mi southwest of Selkirk.	4.44	1953-78, 1988-89	03-27-89	c5.00	c240
04146020	South Branch Flint River near Millville, MI	Lat 43°04'44", long 83°18'25", in SE1/4 sec. 29, T.8 N., R.10 E., Lapeer County, Hydrologic Unit 04080204, at Saginaw Road, 1.6 mi north of Lapeer.	160	1974-89	06-01-89	<6.90	<382
04146450	North Branch Flint River near Columbiaville, MI	Lat 43°11'18", long 83°22'03", in NW1/4 sec. 24, T.9 N., R.9 E., Lapeer County, Hydrologic Unit 04080204, at Barnes Lake Road, 2.9 mi northeast of Columbiaville.	223	1987-89	06-01-89	13.05	767
STREAMS TRIBUTARY TO ST. CLAIR RIVER							
04160350	Pine River near Rattle Run, MI	Lat 42°52'49", long 82°34'04", in NE1/4 sec.9, T.5 N., R.16 E., St. Clair County, Hydrologic Unit 04090001, at Gratiot Road, 1.9 mi northeast of Rattle Run.	135	1974-89	06-23-89	<13.08	<789
STREAMS TRIBUTARY TO LAKE ST. CLAIR							
04161000	Clinton River at Auburn Heights, MI	Lat 42°38'00", long 83°13'28", in NW1/4 sec. 36, T.3 N., R.10 E., Oakland County, Hydrologic Unit 04090003, at Auburn Road in Auburn Heights.	123	1935-40†, 1957-82†, 1983-89	07-27-89	5.25	1,640
04161760	West Branch Stony Creek near Washington, MI	Lat 42°43'53", long 83°06'02", in SE1/4 sec.25, T.4 N., R.11 E., Oakland County, Hydrologic Unit 04090003, at Huron-Clinton Metropolitan Park Road, 3.4 mi west of Washington.	22.5	1965-89	06-23-89	3.05	100
04164010	North Branch Clinton River at Almont, MI	Lat 42°54'59", long 83°02'42", in NE1/4 sec.28, T.6 N., R.12 E., Lapeer County, Hydrologic Unit 04090003, at State Highway 53 in Almont.	9.56	1959-62, 1963-68†, 1969-89	06-10-89	4.47	231
04164050	North Branch Clinton River near Romeo, MI	Lat 42°49'11", long 82°58'35", in NW1/4 sec.31, T.5 N., R.13 E., Macomb County, Hydrologic Unit 04090003, at 33 Mile Road, 2.2 mi northeast of Romeo.	49.7	1959-64, 1965-69†, 1970-89	06-10-89	4.20	962

See footnotes at end of table.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Annual maximum discharge at crest-stage partial-record stations during water year 1989--Continued

					Annual Maximum		
Station No.	Station Name	Location	Drainage area (mi^2)	Period of record	Date	Gage height (ft)	Discharge (ft^3/s)
		STREAMS TRIBUTARY TO LAKE ST. CLAIR--Continued					
04164150	North Branch Clinton River near Meade, MI	Lat 42°43'50", long 82°54'23", in NE1/4 sec.34, T.4 N., R.13 E., Macomb County, Hydrologic Unit 04090003, at 27 Mile Road, 1.9 mi northwest of Meade.	89.6	1959-67, 1968-72†, 1973-89	06-21-89	6.65	1,340
04164200	Coon Creek near Armada, MI	Lat 42°47'41", long 82°52'58", in SW1/4 sec.1, T.4 N., R.13 E., Macomb County, Hydrologic Unit 04090003, at North Road, 3.4 mi south of Armada.	10.0	1959-65, 1966-70†, 1971-89	06-22-89	5.42	171
04164350	Highbank Creek near Armada, MI	Lat 42°28'24", long 82°51'08", in NW1/4 sec.6, T.4 N., R.14 E., Macomb County, Hydrologic Unit 04090003, at 32 Mile Road, 3.0 mi southeast of Armada.	14.9	1959-65, 1965-70†, 1971-89	06-09-89	16.24	1,500
04164360	East Branch Coon Creek near New Haven, MI	Lat 42°45'46", long 82°50'57", in NW1/4 sec.19, T.4 N., R.14 E., Macomb County, Hydrologic Unit 04090003, at 29 Mile Road, 3.4 mi northwest of New Haven.	36.1	1959-67, 1968-72†, 1973-89	06-10-89	8.24	1,450
04164400	Deer Creek near Meade, MI	Lat 42°42'39", long 82°51'32", in NW1/4 sec.6, T.3 N., R.14 E., Macomb County, Hydrologic Unit 04090003, at 25 1/2 Mile Road, 0.9 mi southeast of Meade.	12.7	1959-60, 1960-65†, 1966-89	06-09-89	6.60	352
04164450	McBride Drain near Macomb, MI	Lat 42°41'14", long 82°55'14", in NE1/4 NE1/4 sec.16, T.3 N., R.13 E., Macomb County, Hydrologic Unit 04090003, at 24 Mile Road, 2.2 mi southeast of Macomb.	5.79	1960-64†, 1965-89	06-22-89	8.95	142
04164600	Middle Branch Clinton River near Macomb, MI	Lat 42°42'03", long 82°59'44", in SE1/4 sec.2, T.3 N., R.12 E., Macomb County, Hydrologic Unit 04090003, at Schoenherr Road, 2.0 mi west of Macomb.	22.2	1959-64, 1965-69†, 1971-89	06-22-89	11.94	745
04164800	Middle Branch Clinton River at Macomb, MI	Lat 42°42'23", long 82°57'33", in SW1/4 sec.5, T.3 N., R.13 E., Macomb County, Hydrologic Unit 04090003, at Romeo Plank Road, 0.4 mi north of Macomb.	41.0	1959-62, 1963-68†, 1969, 1970-82†, 1983-89	06-22-89	14.69	1,420
04165200	Gloede Ditch near Waldenburg, MI	Lat 42°37'39", long 82°57'10", in SW1/4 sec. 32, T.3 N., R.13 E., Macomb County, Hydrologic Unit 04090003, 2.2 mi south of Waldenburg.	16.0	1959, 1959-64†, 1965-89	06-09-89	16.40	368
		STREAMS TRIBUTARY TO DETROIT RIVER					
04168660	Frank and Poet Drain at Trenton, MI	Lat 42°09'19", long 83°12'22", in NW1/4 sec.13, T.4 S., R.10 E., Wayne County, Hydrologic Unit 04090004, at King Road in Trenton.	19.3	1972-89	05-31-89	8.16	283
		STREAMS TRIBUTARY TO LAKE ERIE					
04168800	Huron River near Andersonville, MI	Lat 42°41'35", long 83°29'56", in NW1/4 SE1/4 sec.3, T.3 N., R.8 E., Oakland County, Hydrologic Unit 04090005, at White Lake Road, 2.5 mi south of Andersonville.	14.0	1974-89	09-09-89	<1.95	<66
04173250	Mill Creek near Lima Center, MI	Lat 42°15'56", long 83°56'45", in NE1/4 sec.34, T.2 S., R.4 E., Washtenaw County, Hydrologic Unit 04090005, at Guenther Road, 2.0 mi upstream from North Fork Mill Creek, and 2.2 mi south of Lima Center.	47.3	1973-89	05-31-89	9.63	514
04175960	South Branch River Raisin near Adrian, MI	Lat 41°55'03", long 84°00'37", in SE1/4 sec.25, T.6 S., R.3 E., Lenawee County, Hydrologic Unit 04100002, at Howell Highway, 2.0 mi northeast of Adrian.	165	1979-89	06-01-89	10.74	2,050

See footnotes at end of table.

Annual maximum discharge at crest-stage partial-record stations during water year 1989--Continued

Station No.	Station Name	Location	Drainage area (mi^2)	Period of record	Annual Maximum Date	Annual Maximum Gage height (ft)	Annual Maximum Discharge (ft^3/s)
STREAMS TRIBUTARY TO LAKE ERIE--Continued							
04176400	Saline River near Saline, MI	Lat 42°07'50", long 83°46'35", in SW1/4 sec.18, T.4 S., R.6 E., Washtenaw County, Hydrologic Unit 04100002, at Maple Road, 2.8 mi south of Saline.	94.6	1966-77†, 1978-89	06-01-89	12.36	2,120

† Operated as a continuous-record gaging station.
* Also a low-flow partial-record station.
a Maximum gage height, 9.93 ft, sometime prior to May 26, backwater from ice.
b Occurred Mar. 30, backwater from ice.
c Estimated.
d Approximately.
e Occurred Mar. 29, backwater from ice.
f Maximum gage height, greater than 5.86 ft, Dec. 31, backwater from ice.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Low-flow partial-record stations

Measurements of streamflow in the area covered by this report made at low-flow partial-record stations are given in the following table. These measurements were made during periods of base flow when streamflow is primarily from ground-water storage. These measurements, when correlated with the simultaneous discharge of a nearby stream where continuous records are available, will give a picture of the low-flow potentiality of a stream. The column headed "Period of record" shows the water years in which measurements were made at the same, or practically the same, site.

Discharge measurements made at low-flow partial-record stations during water year 1989

Station No.	Station Name	Location	Drainage area (mi²)	Period of record	Measurements	
					Date	Discharge (ft³/s)
STREAMS TRIBUTARY TO LAKE SUPERIOR						
04044400	Carp River near Negaunee, MI	Lat 46°31'29", long 87°34'25", in SE1/4 sec.29, T.48 N., R.26 W., Marquette County, Hydrologic Unit 04020105, at U.S. Highway 41, 2.0 mi northeast of Negaunee.	51.4	1961-86†a, 1987-89a,	07-07-89 07-27-89 08-16-89 09-07-89	b38.5 b45.9 b54.4 b51.6
STREAMS TRIBUTARY TO LAKE MICHIGAN						
04057580	Whitefish River near Rapid River, MI	Lat 45°57'56", long 86°55'15", in SE1/4 NW1/4 sec.10, T.41 N., R.21 W., Delta County, Hydrologic Unit 04030111, about 800 ft downstream from Chippeny Creek, 3.5 mi northeast of Rapid River.	284	1973-89	03-09-89 07-14-89 08-18-89 08-30-89	140 157 82.2 75.8
04058120	Green Creek near Palmer, MI	Lat 46°22'22", long 87°36'21", in NW1/4 sec.19, T.46 N., R.26 W., Marquette County, Hydrologic Unit 04030110, at County Highway 565, 4.5 mi south of Palmer.	8.42	1961-65, 1970-89c	10-18-88 05-16-89 07-20-89 07-27-89 08-15-89	b6.12 b2.02 b2.26 b2.37 b8.63
04059034	Escanaba River near Wells, MI	Lat 45°48'22", long 87°05'51", in SW1/4 NW1/4 sec.1, T.39 N., R.23 W., Delta County, Hydrologic Unit 04030110, 600 ft downstream from Bichler Creek, 2.0 mi northwest of Wells, and 2.5 mi upstream from mouth.	d920	1981-89c	01-26-89 07-14-89 08-24-89 09-11-89	b569 b411 b366 b346
04096517	South Branch Hog Creek Tributary near Allen, MI	Lat 41°57'33", long 84°49'33", in SW1/4 SW1/4 sec.7, T.6 S., R.4 W., Hillsdale County, Hydrologic Unit 04050001, at Squires Road, 0.3 mi upstream from mouth, and 3.0 mi west of Allen.	2.61	1969-89	11-01-88 01-24-89 05-30-89 08-22-89	4.60 1.54 1.90 1.61
04114594	Maple River near St. Johns, MI	Lat 43°02'43", long 84°28'11", in SE1/4 SE1/4 sec.30, T.8 N., R.1 W., Clinton County, Hydrologic Unit 04050005, at Colony Road, 4.5 mi northeast of St. Johns.	--	1981-89	10-26-88 04-17-89 08-16-89 09-26-89	81.5 116 34.0 62.0
*04120295	Black Creek near Muskegon, MI	Lat 43°12'14", long 86°09'52", in NE1/4 NW1/4 sec.1, T.9 N., R.16 W., Muskegon County, Hydrologic Unit 04060101, at Mill Iron Road, 4.8 mi east of Muskegon, and 4.9 mi upstream from mouth.	d39	1974-89	02-14-89 03-28-89 08-01-89 09-14-89	47.2 b110 22.4 b38.4
04121239	Clam River at Cadillac, MI	Lat 44°15'49", long 85°24'04", in NE1/4 NE1/4 sec.33, T.22 N., R.9 W., Wexford County, Hydrologic Unit 04060102, at Smith Street in Cadillac.	d48	1983-84, 1986-89	10-14-88 02-09-89 05-08-89 08-03-89	3.17 42.5 48.3 20.9

† Operated as a continuous-record gaging station.
* Also a crest-stage partial-record station.
a Affected by domestic diversion.
b Not base flow.
c Affected by diversion for industrial use.
d Approximately.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Special study and miscellaneous sites

Discharge measurements in the following table were made at special study and miscellaneous sites throughout the State.

Discharge measurements made at special study and miscellaneous sites during water year 1989

Station No.	Stream	Tributary to	Location	Drainage area (mi²)	Measured previously (water years)	Measurements	
						Date	Discharge (ft³/s)
			STREAMS TRIBUTARY TO LAKE SUPERIOR				
04034100	Bond Falls Lower By-Pass	Middle Branch Ontonagon River	Lat 46°24'27", long 89°07'44", in SE1/4 SW1/4 sec.1, T.46 N., R.39 W., Ontonagon County, Hydrologic Unit 04020102, at Bond Falls Road, 2.2 mi west of Calderwood.	--	1942,1945, 1963-64, 1967,1969, 1971-72, 1974, 1979-81, 1983-84, 1987-88	10-25-88 06-20-89	a28.7 a37.1
04044200	Carp Creek	Deer Lake	Lat 46°29'11", long 87°41'21", in NW1/4 sec.9, T.47 N., R.27 W., Marquette County, Hydrologic Unit 04020105, at highway 41A in Ishpeming.	16.5	1961-70b 1970-89c	05-17-89 09-07-89	*20.6 *9.38
			STREAMS TRIBUTARY TO LAKE MICHIGAN				
04062010	Brule River	Menominee River	Lat 45°56'51", long 88°13'04", in NW1/4 SW1/4 sec.17, T.41 N., R.31 W., Michigan Meridian, Iron County, Hydrologic Unit 04030106, 150 ft downstream from Brule Dam, 2.3 mi northeast of Florence, WI	1,020	1945-46 1953	06-21-89 06-21-89 06-21-89 06-21-89 07-26-89 07-26-89 08-10-89	a29.4 a29.4 a36.0 a35.2 a56.8 a60.2 a135
04062492	Michigamme River	Menominee River	Lat 46°09'32", long 88°14'15", in NE1/4 NW1/4, sec.6, T.43 N., R.31 W., Iron County, Hydrologic Unit 04030107, 500ft downstream from Way Dam, 1.0 mi northeast of Kelso Junction.	--	--	08-16-69 08-17-89	a167 a536
04062497	Michigamme River	Menominee River	Lat 46°07'50", long 88°13'01", in NW1/4 NW1/4, sec.17, T.43 N., R.31 W., Iron County, Hydrologic Unit 04030107, 0.3 mi downstream from Hemlock Falls Dam, 2.1 mi southeast of Kiernan.	--	--	08-16-89 08-16-89 08-17-89 08-17-89	a162 a161 a499 a497
04065110	Menominee River	Lake Michigan	Lat 45°45'53", long 87°58'00", in NE1/4 sec.23, T.39 N., R.30 W., Dickinson County, Hydrologic Unit 04030108, at intake at Champion International Corp. Quinnesec Pulpmill, 2.0 mi southeast of Niagara, WI.	2,470	1987-88	10-07-88 01-10-89 07-18-89	a1,220 a2,030 a1,380
04065548	Sturgeon River	Menominee River	Lat 45°47'19", long 87°47'03", in SE1/4 NE1/4 sec.8, T.39 N., R.28 W., Dickinson County, Hydrologic Unit 04030108, 300 ft downstream from Sturgeon Dam, 1.7 mi east of Loretto.	--	--	09-05-89 09-05-89 09-26-89	a179 a180 a2.78
04096642	St. Joseph River	Lake Michigan	Lat 42°01'35", long 85°14'06", in NW1/4 NW1/4 sec.22, T.5 S., R.8 W., Branch County, Hydrologic Unit 04050001, at Athens Road, 1.5 mi north of Sherwood.	--	1987	08-07-89	d326
04101820	Dowagiac River	St. Joseph River	Lat 41°50'42", long 86°15'45", in NW1/4 SW1/4 sec.23, T.7 S., R.17 W., Berrien County, Hydrologic Unit 04050001, at State Highway 140, in Niles.	--	--	07-20-89	d251
04102200	South Branch Paw Paw River	Paw Paw River	Lat 42°15'23", long 85°54'26", in NW1/4 NE1/4 sec.35, T.2 S., R.14 W., Van Buren County, Hydrologic Unit 04050001, at 3750th Street, 3.0 mi north of Paw Paw.	--	1955	07-17-89	d78.4
04102220	North Branch Paw Paw River	Paw Paw River	Lat 42°15'59", long 85°53'36", in SW1/4 NE1/4 sec.25, T.2 S., R.14 W., Van Buren County, Hydrologic Unit 04050001, at 3550th Street, 3.4 mi north of Paw Paw.	63.5	1962-64 1977	07-17-89	d52.1

See footnotes at end of table.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements made at special study and miscellaneous sites during water year 1989--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi^2)	Measured previously (water years)	Measurements	
						Date	Discharge (ft^3/s)
			STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued				
04102400	Paw Paw River	St. Joseph River	Lat 42°13'38", long 86°07'25", in NW1/4 NW1/4 sec.12, T.3 S., R.16 W., Van Buren County, Hydrologic Unit 04050001, at 5950th Street, 2.5 mi northeast of Hartford.	--	--	07-17-89	d184
04102470	Paw Paw River	St. Joseph River	Lat 42°11'38", long 86°15'31", in SW1/4 NW1/4 sec.23, T.3 S., R.17 W., Berrien County, Hydrologic Unit 04050001, at State Highway 140, in Watervliet.	--	1978	07-17-89	d226
04103080	South Branch Rice Creek	Rice Creek	Lat 42°17'57", long 84°42'28", in SW1/4 NE1/4 sec.18, T.2 S., R.3 W., Jackson County, Hydrologic Unit 04050003, at State Highway 99, 3.8 mi northeast of Albion.	18.2	--	09-07-89	d14.5
04103100	South Branch Rice Creek	Rice Creek	Lat 42°17'22", long 84°45'25", in NE1/4 NE1/4 sec.22, T.2 S., R.4 W., Calhoun County, Hydrologic Unit 04050003, at 28 Mile Road, 3.0 mi north of Albion.	28.6	1983	09-07-89	d24.8
04103120	South Branch Rice Creek	Rice Creek	Lat 42°17'51", long 84°49'43", in SW1/4 NW1/4 sec.18, T.2 S., R.4 W., Calhoun County, Hydrologic Unit 04050003, at 24 Mile Road, 2.0 mi northeast of Marengo.	40.5	1983	09-07-89	d37.1
04103170	North Branch Rice Creek	Rice Creek	Lat 42°20'03", long 84°48'16", in SW1/4 SE1/4 sec.32, T.1 S., R.4 W., Calhoun County, Hydrologic Unit 04050003, at L Drive North, 6.2 mi northwest of Albion.	30.5	--	09-07-89	d13.2
04103460	Rice Creek	Kalamazoo River	Lat 42°17'49", long 84°51'47", in NE1/4 SW1/4 sec.14, T.2 S., R.5 W., Calhoun County, Hydrologic Unit 04050003, at 22 1/2 Mile Road, 2.0 mi north of Marengo.	77.4	1983	09-07-89	d54.2
04103470	Rice Creek	Kalamazoo River	Lat 42°17'32", long 84°54'25", in SE1/4 SE1/4 sec.17, T.2 S., R.5 W., Calhoun County, Hydrologic Unit 04050003, at 20 Mile Road, 2.2 mi northeast of Marshall.	89.3	1983, 1988	09-07-89	d64.6
04104700	Battle Creek	Kalamazoo River	Lat 42°21'51", long 85°07'20", in SE1/4 SE1/4 sec.21, T.1 S., R.7 W., Calhoun County, Hydrologic Unit 04050003, at Nine Mile Road, 4.4 mi northeast of Battle Creek.	--	--	01-25-89 07-12-89 08-23-89	*137 *79.1 61.2
04104950	Wanadoga Creek	Battle Creek	Lat 42°22'12", long 85°07'44", in NW1/4 SE1/4 sec.21, T.1 S., R.7 W., Calhoun County, Hydrologic Unit 04050003, at Q Drive North, 1.3 mi west of Pennfield.	--	1965, 1983	01-25-89 07-12-89 08-23-89	*42.4 *16.9 19.8
04108900	Grand River	Lake Michigan	Lat 42°10'08", long 84°23'02", in SE1/4 NE1/4 sec.35, T.3 S., R.1 W., Jackson County, Hydrologic Unit 04050004, at Draper Road, 2.0 mi south of Vandercook Lake.	41.0	1961, 1963-65, 1974-79, 1987	06-13-89 09-15-89	d53.5 d33.0
04112660	Sycamore Creek	Red Cedar River	Lat 42°32'54", long 84°26'38", in SE1/4 NE1/4 sec.20, T.2 N., R.1 W., Ingham County, Hydrologic Unit 04050004, at West Service Drive, 1.3 mi south of Mason.	--	--	07-25-89 09-12-89 09-27-89	d0.65 *d2.23 *d0.93
04112665	Talmadge Drain	Sycamore Creek	Lat 42°33'06", long 84°25'24", in NE1/4 NE1/4 sec.21, T.2 N., R.1 W., Ingham County, Hydrologic Unit 04050004, at Eden Road, 1.2 mi southeast of Mason.	--	--	07-25-89 09-12-89	d1.58 *d2.40
04112675	Willow Creek	Sycamore Creek	Lat 42°34'12", long 84°27'10", in SW1/4 SE1/4 sec.8, T.2 N., R.1 W., Ingham County, Hydrologic Unit 04050004, at ramp on northbound U.S. Highway 127, in Mason.	--	--	07-25-89 09-12-89 09-27-89	d3.68 *d10.5 *d4.25
04112694	Unnamed Tributary	Sycamore Creek	Lat 42°35'00", long 84°26'30", in NW1/4 SW1/4 sec.4, T.2 N., R.1 W., Ingham County, Hydrologic Unit 04050004, at North Jefferson Avenue, in Mason.	2.6	1971	07-25-89 09-12-89 09-27-89	d0.40 *d1.59 *d0.67

See footnotes at end of table.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements made at special study and miscellaneous sites during water year 1989--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi²)	Measured previously (water years)	Measurements	
						Date	Discharge (ft³/s)
			STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued				
04112695	Sycamore Creek	Red Cedar River	Lat 42°35'23", long 84°26'50", in SE1/4 NE1/4 sec.5, T.2 N., R.1 W., Ingham County, Hydrologic Unit 04050004, downstream of confluence with unnamed tributary near sewage treatment plant, in Mason.	--	--	09-27-89	*d10.1
04112698	Aurelius and VeVay Drain	Sycamore Creek	Lat 42°35'56", long 84°27'53", in SE1/4 SE1/4 sec.31, T.3 N., R.1 W., Ingham County, Hydrologic Unit 04050004, at Dart Road, 1.6 mi northwest of Mason.	--	--	07-25-89 09-12-89 09-27-89	d0.77 d1.51 d0.86
04112700	Sycamore Creek	Red Cedar River	Lat 42°36'38", long 84°27'58", in NE1/4 NE1/4 sec.31, T.3 N., R.1 W., Ingham County, Hydrologic Unit 04050004, at Harper Road, 2.6 mi northwest of Mason.	39.5	1955, 1964-67	09-27-89	d11.8
04112800	Mud Creek	Sycamore Creek	Lat 42°37'33", long 84°27'27", in NE1/4 NW1/4 sec.29, T.3 N., R.1 W., Ingham County, Hydrologic Unit 04050004, at Hagadorn Road, 3.3 mi north of Mason.	30.8	1955, 1964-67, 1985	07-25-89 09-12-89 09-27-89	d3.78 d30.6 *d6.97
04116500	Flat River	Grand River	Lat 43°03'10", long 85°15'50", in SE1/4 NW1/4 sec.28, T.8 N., R.8 W., Ionia County, Hydrologic Unit 04050006, at former gaging station, at Ingalls Road, 0.5 mi south of Smyrna.	528	1951-86† 1988	10-13-88	*d340
04117300	High Bank Creek	Thornapple Lake	Lat 42°37'17", long 85°10'47", in NW1/4 NE1/4 sec.30, T.3 N., R.7 W., Barry County, Hydrologic Unit 04050007, at Thornapple Lake Road, at Morgan.	33.9	1964	10-31-88	d30.0
04118400	Rogue River	Grand River	Lat 43°09'38", long 85°41'23", in NW1/4 NW1/4 sec.24, T.9 N., R.12 W., Kent County, Hydrologic Unit 04050006, at 13 Mile Road, 1.1 mi east of Sparta.	155	1963-65, 1988	10-13-88	*d79.3
04126800	Crystal River	Lake Michigan	Lat 44°54'00", long 85°57'15", in NW1/4 SW1/4 sec.24, T.29 N., R.14 W., Leelanau County, Hydrologic Unit 04060104, 0.7 mi downstream from Glen Lake, and 1.8 mi east of Glen Arbor.	--	1946-51, 1988	10-10-88	*d48.5
04126802	Crystal River	Lake Michigan	Lat 44°54'10", long 85°57'46", in SE1/4 NE1/4 sec.23, T.29 N., R.14 W., Leelanau County, Hydrologic Unit 04060104, at County Road 675, 1.4 mi east of Glen Arbor.	42.0	1979-82, 1988	10-10-88	*d53.1
04126805	Crystal River	Lake Michigan	Lat 44°54'18", long 85°58'30", in SW1/4 NW1/4 sec.23, T.29 N., R.14 W., Leelanau County, Hydrologic Unit 04060104, at State Highway 22, 0.9 mi northeast of Glen Arbor.	--	1988	10-10-88	*d48.8
04126957	Failing Creek	North Branch Boardman River	Lat 44°42'26", long 85°11'56", in SE1/4 NE1/4 sec.30, T.27 N., R.7 W., Kalkaska County, Hydrologic Unit 04060105, at U.S. Highway 131, 2.1 mi southwest of Kalkaska.	--	--	09-14-89	*0.70
04127845	Unnamed Tributary	South Arm Lake Charlevoix	Lat 45°13'11", long 85°09'00", in SW1/4 SE1/4 sec.27, T.33 N., R.7 W., Charlevoix County, Hydrologic Unit 04060105, 1300 ft upstream from mouth, 4.7 mi north of East Jordan.	--	--	08-21-89	d1.16
			STREAMS TRIBUTARY TO LAKE HURON				
04159012	Pinnebog River	Lake Huron	Lat 43°50'53", long 83°09'44", in NE1/4 NE1/4 sec.3, T.16 N., R.11 E., Huron County, Hydrologic Unit 04080103, at Berne Road, 2.3 mi northeast of Elkton.	73.3	1988	10-20-88 12-07-88 04-14-89	42.1 *33.9 61.6

See footnotes at end of table.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements made at special study and miscellaneous sites during water year 1989--Continued

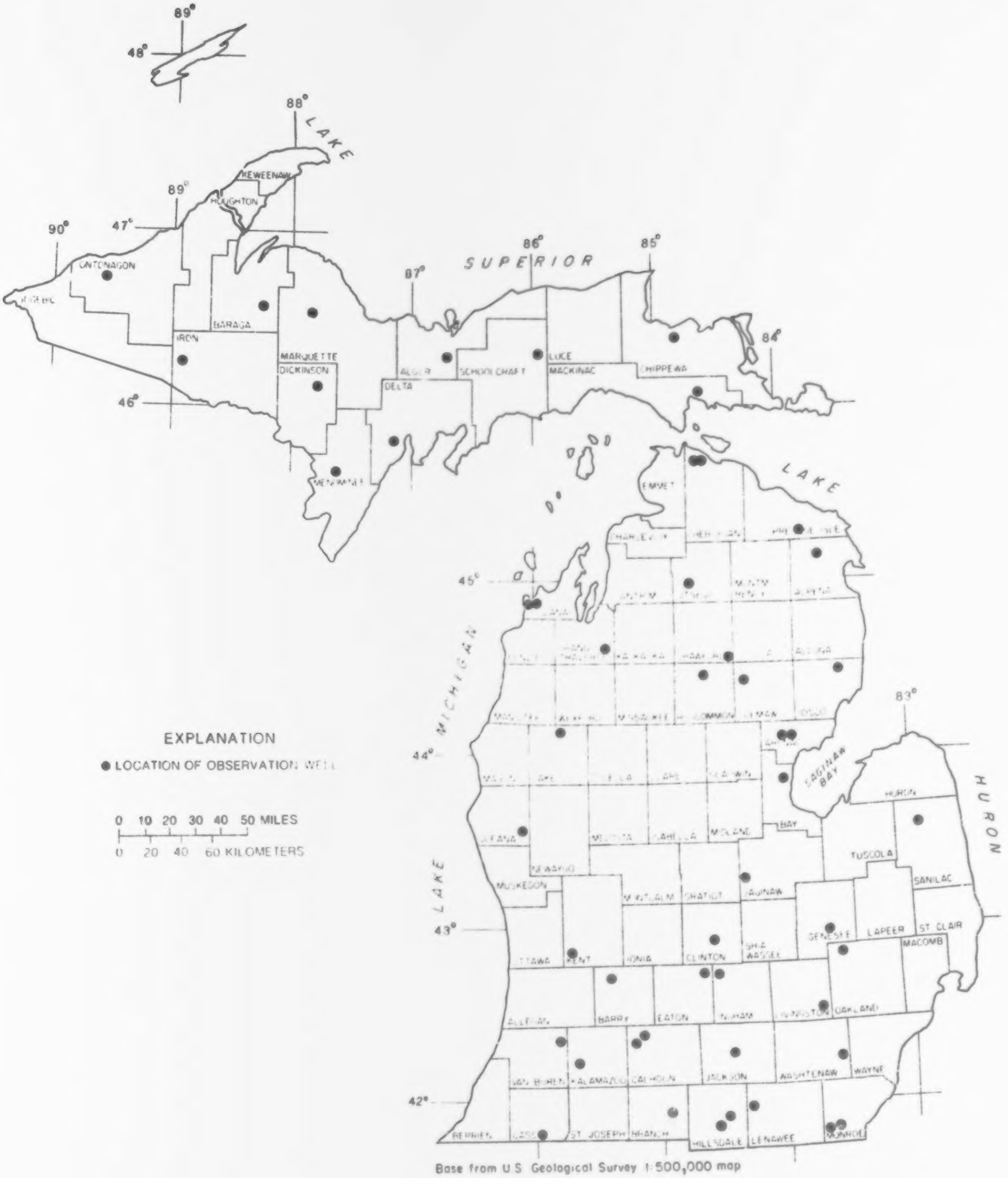
Station No.	Stream	Tributary to	Location	Drainage area (mi²)	Measured previously (water years)	Measurements	
						Date	Discharge (ft³/s)
			STREAMS TRIBUTARY TO LAKE HURON--Continued				
04159037	Bad Axe Creek	Pinnebog River	Lat 43°53'28", long 83°08'28", in NW1/4 NW1/4 sec.24, T.17 N., R.11 E., Huron County, Hydrologic Unit 04080103, at Filion Road, 5.5 mi northeast of Elkton.	28.3	1988	10-18-88 12-07-88 04-13-89	11.6 *17.3 30.8
04159063	Taft Drain	Pinnebog River	Lat 43°57'52", long 83°05'53", in SE1/4 SW1/4 sec.20, T.18 N., R.12 E., Huron County, Hydrologic Unit 04080103, at Oak Beach Road, 2.0 mi northeast of Pinnebog.	31.1	1988	10-18-88 12-07-88 04-13-89	16.4 *10.6 40.5
04159069	New River	Lake Huron	Lat 44°00'05", long 82°52'25", in SW1/4 SE1/4 sec.7, T.18 N., R.14 E., Huron County, Hydrologic Unit 04080104, at Stoddard Road, 2.8 mi southwest of Huron City.	22.1	1988	10-19-88 12-08-88 04-13-89	*5.32 *4.82 19.4
04159075	East Branch Willow Creek	Willow Creek	Lat 43°53'59", long 82°50'22", in SW1/4 SW1/4 sec.16, T.17 N., R.14 E., Huron County, Hydrologic Unit 04080104, at Filion Road, 2.1 mi south of Redman.	32.0	1988	10-20-88 12-08-88 04-13-89	8.46 *7.89 37.6
04159077	Willow Creek	Lake Huron	Lat 43°55'42", long 82°51'13", in NW1/4 NE1/4 sec.8, T.17 N., R.14 E., Huron County, Hydrologic Unit 04080104, at Redman Road, 1.0 mi west of Redman.	69.8	1988	10-19-88 12-08-88 04-13-89	16.1 *23.3 85.8
04159078	Willow Creek	Lake Huron	Lat 44°00'02", long 82°51'15", in NW1/4 NE1/4 sec.17, T.18 N., R.14 E., Huron County, Hydrologic Unit 04080104, at Stoddard Road, 2.3 mi southwest of Huron City.	74.4	1988	10-19-88 12-08-88 04-13-89	14.3 *28.5 83.2
04159096	Rock Falls Creek	Lake Huron	Lat 43°48'40", long 82°39'45", in NW1/4 SW1/4 sec.24, T.16 N., R.15 E., Huron County, Hydrologic Unit 04080104, at Schock Road, 2.4 mi southwest of Harbor Beach.	30.4	1988	10-19-88 12-08-88 04-12-89	2.87 *9.67 36.0
04159104	Elm Creek	Lake Huron	Lat 43°44'24", long 82°38'33", in SE1/4 NE1/4 sec.13, T.15 N., R.15 E., Huron County, Hydrologic Unit 04080104, at Edwards Road, 2.8 mi northwest of White Rock.	24.4	1988	10-19-88 12-08-88 04-12-89	2.18 *6.14 20.0
			STREAMS TRIBUTARY TO LAKE ERIE				
04172210	Honey Creek	Portage Lake	Lat 42°26'35", long 83°55'28", in SW1/4 SW1/4 sec.25, T.1 N., R.4 E., Livingston County, Hydrologic Unit 04090005, at Darwin Road, 1.3 mi southeast of Pinckney.	--	--	08-09-89	*d5.92
04172360	Portage Creek	Bass Lake	Lat 42°25'50", long 84°03'30", in NW1/4 SW1/4 sec.35, T.1 N., R.3 E., Livingston County, Hydrologic Unit 04090005, at Unadilla Road, in Unadilla.	--	--	08-09-89	*d8.85
04172500	Portage River	Little Portage Lake	Lat 42°55'40", long 83°57'35", in SE1/4 SW1/4 sec.34, T.1 N., R.4 E., Livingston County, Hydrologic Unit 04090005, at former gaging station, at Tiplady Road, 2.2 mi southwest of Pinckney.	79.1	1945-71†, 1972-79c, 1983	08-09-89	*d18.6
04172605	Portage Lake Outlet	Huron River	Lat 42°25'09", long 83°54'20", in SE1/4 NE1/4 sec.1, T.1 S., R.4 E., Washtenaw County, Hydrologic Unit 04090005, at McGregor Road, at old outlet structure, 1.2 mi northeast of Dover.	--	1977	08-09-89	de7.14
04172606	Portage Lake Outlet	Huron River	Lat 42°24'55", long 83°54'20", in SE1/4 SE1/4 sec.1, T.1 S., R.4 E., Washtenaw County, Hydrologic Unit 04090005, at McGregor Road near DNR access site, 1.0 mi northeast of Dover.	--	1977-78	05-17-89 06-13-89 08-09-89	d65.4 *d105 *d19.0

See footnotes at end of table.

Discharge measurements made at special study and miscellaneous sites during water year 1989--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi²)	Measured previously (water years)	Measurements Date	Measurements Discharge (ft³/s)
			STREAMS TRIBUTARY TO LAKE ERIE--Continued				
04176298	North Branch Macon Creek	Macon Creek	Lat 42°05'11", long 83°45'44", in NW1/4 SE1/4 sec.31, T.4 S., R.6 E., Washtenaw County, Hydrologic Unit 04100002, at Ridge Road, 5.6 mi south of Saline.	--	--	03-29-89 04-14-89 05-11-89 07-10-89	d78.0 *d6.54 *d1.62 *d0.86
04176349	Saline-Bridgewater Drain	Saline River	Lat 42°08'18", long 83°52'08", in NW1/4 NW1/4 sec.17, T.4 S., R.5 E., Washtenaw County, Hydrologic Unit 04100002, at Feldcamp Road, 200 ft upstream from mouth, 0.5 mi north of Benton.	--	1981-82	03-29-89 04-14-89 05-11-89 07-10-89	d42.8 *d4.70 *d2.50 *d2.52
04176355	Bauer Drain	Saline River	Lat 42°09'38", long 83°51'01", in SE1/4 NW1/4 sec.4, T.4 S., R.5 E., Washtenaw County, Hydrologic Unit 04100002, at Austin Road, 3.5 mi west of Saline.	7.30	1970-72, 1981-82	03-29-89 04-14-89 05-11-89 07-10-89	d44.5 *d5.61 *d1.51 *d0.76
04176358	Saline River	River Raisin	Lat 42°09'39", long 83°50'39", in NW1/4 SE1/4 sec.4, T.4 S., R.5 E., Washtenaw County, Hydrologic Unit 04100002, at Austin Road, 3.0 mi west of Saline.	--	--	03-29-89	d178
04176365	Saline River	River Raisin	Lat 42°10'15", long 83°49'32", in SE1/4 SW1/4 sec.34, T.3 S., R.5 E., Washtenaw County, Hydrologic Unit 04100002, at Dell Road, 2.0 mi west of Saline.	44.3	1964, 1980-82, 1988	04-14-89 05-11-89 07-10-89	*d37.0 *d14.8 *d12.8
04176400	Saline River	River Raisin	Lat 42°07'50", long 83°46'35", in NW1/4 SW1/4 sec.18, T.4 S., R.5 E., Washtenaw County, Hydrologic Unit 04100002, at former gaging station, at Maple Road, 2.8 mi south of Saline.	94.6	1966-77†, 1978-89c	04-14-89 05-11-89 07-10-89	*d77.1 *d33.2 *d30.1
04176439	Saline River	River Raisin	Lat 41°58'59", long 83°36'59", in NE1/4 NE1/4 sec.8, T.6 S., R.7 E., Monroe County, Hydrologic Unit 04100002, at Bigelow Road, 0.6 mi upstream from mouth, 3.0 mi east of Dundee.	--	1981-82	04-14-89 05-11-89 07-10-89	*d112 *d48.5 *d35.3
04177063	East Branch St. Joseph River	St. Joseph River	Lat 41°51'47", long 84°30'50", in SW1/4 NW1/4 sec.14, T.7 S., R.2 W., Hillsdale County, Hydrologic Unit 04100003, at Tripp Road, 1.9 mi west at Pittsford.	22.1	--	09-15-89	*d17.6
04177064	East Branch St. Joseph River	St. Joseph River	Lat 41°51'16", long 84°30'38", in SW1/4 SW1/4 sec.14, T.7 S., R.2 W., Hillsdale County, Hydrologic Unit 04100003, at Way Road, 2.0 mi southwest of Pittsford.	24.2	--	09-15-89	*d21.4
04177067	East Branch St. Joseph River	St. Joseph River	Lat 41°50'10", long 84°28'38", in SE1/4 NE1/4 sec.25, T.7 S., R.2 W., Hillsdale County, Hydrologic Unit 04100003, at Pittsford Road, 2.0 mi south of Pittsford.	27.1	--	09-15-89	*d24.4

* Base flow.
† Operated as a continuous-record gaging station.
a Affected by regulation and diversion.
b Operated as a low-flow partial-record station.
c Operated as a crest-stage partial-record station.
d Discharge measurement made by employees of Michigan Department of Natural Resources.
e Water flowing from Huron River into Portage Lake.



Base from U.S. Geological Survey 1:500,000 map

Figure 10.--Location of observation wells published in this report.

ALGER COUNTY

461608086373801. Local number, 45N 19W 25BDCD.

LOCATION.--Lat 46°16'08", long 86°37'38", Hydrologic Unit 04060106, 250 ft northwest of State Highway 44, and 0.2 mi northeast of Kentucky. Owner: U.S. Forest Service.

AQUIFER.--Glacial deposits of Pleistocene age.

WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 66 ft.

INSTRUMENTATION.--Quarterly measurement.

DATUM.--Elevation of land-surface datum is 850 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 3.6 ft above land-surface datum.

REMARKS.--Water temperature also measured.

PERIOD OF RECORD.--June 1959 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 6.35 ft below land-surface datum, June 20, 1960; lowest measured, 14.19 ft below land-surface datum, Apr. 3, 1964.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 19	12.62	MAR 8	11.75	MAY 19	10.88	AUG 18	11.43

ALPENA COUNTY

450850083393401. Local number, 32N 6E 23DDDA.

LOCATION.--Lat 45°08'50", long 83°39'34", Hydrologic Unit 04070006, on Graham Road, 3 mi east and 1.5 mi north of Long Rapids. Owner: U.S. Geological Survey.

AQUIFER.-- Sand of Pleistocene age.

WELL CHARACTERISTICS.--Drilled water-table observation well, diameter 6 in., depth 88 ft, screened 79 to 88 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 713 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood instrument shelf, 2.7 ft above land-surface datum.

REMARKS.--Bottom of hole near top of bedrock.

PERIOD OF RECORD.--November 1976 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 13.61 ft below land-surface datum, May 22, 1983; lowest recorded, 30.01 ft below land-surface datum, Mar. 27, 1982.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	25.13	25.11	22.53	22.36	23.36	24.87	21.04	19.42	19.76	19.94	22.59	24.45
10	25.03	24.74	22.31	22.67	23.65	25.02	19.83	19.71	19.83	20.22	23.05	24.72
15	25.19	24.27	22.42	22.71	24.04	25.18	18.89	19.68	19.73	20.66	23.27	24.95
20	25.24	23.71	22.28	23.03	24.14	25.12	18.13	19.58	19.79	21.18	23.51	25.21
25	25.19	23.27	22.27	23.17	24.36	25.15	18.28	19.66	19.62	21.71	23.89	25.46
EOM	25.18	22.85	22.27	23.24	24.56	23.03	19.15	19.71	19.73	22.27	24.21	25.73

WTR YR 1989 HIGHEST 17.76 APR 23 LOWEST 25.73 SEP 30

ARENAC COUNTY

440342083542801. Local number, 19N 5E 7DABA1.

LOCATION.--Lat 44°03'42", long 83°54'28", Hydrologic Unit 04080101, 3 mi northeast of Omer. Owner: U.S. Geological Survey.

AQUIFER.--Saginaw Formation of Pennsylvanian age.

WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 185 ft., screened 180 to 185 ft.

INSTRUMENTATION.--Monthly measurement.

DATUM.--Elevation of land-surface datum is 667 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.00 ft above land-surface datum.

PERIOD OF RECORD.--June 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 9.28 ft below land-surface datum, July 15, 1980; lowest measured, 11.85 ft below land-surface datum, Aug. 31, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 11	11.35	DEC 19	10.61	MAR 10	10.75	JUN 9	10.48	JUL 5	10.77	AUG 24	11.43
NOV 16	10.44	JAN 23	10.53	APR 14	10.52						

ARENAC COUNTY--Continued

440342083542801. Local number, 19N 5E 7DABA2.
LOCATION.--Lat 44°03'42", long 83°54'28", Hydrologic Unit 04080101, 3 mi northeast of Omer. Owner: U.S. Geological Survey.
AQUIFER.--Lake bed sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 21 ft, screened 16 to 21 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 667 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.20 ft above land-surface datum.
PERIOD OF RECORD.--June 1980 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 2.35 ft below land-surface datum, Apr. 29, 1985; lowest measured, 7.05 ft below land-surface datum, Oct. 16, 1987.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 11	6.19	DEC 19	5.31	MAR 10	5.91	JUN 9	4.15	JUL 5	4.32	AUG 24	5.53
NOV 16	4.83	JAN 23	5.55	APR 14	4.01						

BARAGA COUNTY

463353088144301. Local number, 48N 32W 12DDCC.
LOCATION.--Lat 46°33'53", long 88°14'43", Hydrologic Unit 04030107, 95 ft north of U.S. Highway 41, and 0.5 mi southeast of Nestoria Road. Owner: Michigan Department of Transportation.
AQUIFER.--Sand and gravel of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 1.5 in., depth 10 ft, screened 7 to 10 ft.
INSTRUMENTATION.--Monthly measurement by observer.
DATUM.--Elevation of land-surface datum is 1,630 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 4.78 ft above land-surface datum.
PERIOD OF RECORD.--September 1948 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 3.27 ft below land-surface datum, Apr. 30, 1965; lowest measured, 9.93 ft below land-surface datum, Jan. 30, 1987.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 30	6.58	DEC 28	7.02	FEB 28	7.44	APR 30	5.46	JUN 26	7.00	AUG 2	6.66
NOV 21	5.80	31	7.03	MAR 23	7.48	MAY 24	6.94	30	7.06	31	6.36
30	6.53	JAN 31	7.25	31	6.74	31	7.02	JUL 31	6.67	SEP 30	6.36

BARRY COUNTY

424540085232001. Local number, 4N 9W 5DAAA.
LOCATION.--Lat 42°45'40", long 85°23'20", Hydrologic Unit 04050007, on Soloman Road, 4 mi east and 3.5 mi north of Middleville. Owner: Michigan Department of Natural Resources.
AQUIFER.--Glacial deposits of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 2 in., depth 131 ft.
INSTRUMENTATION.--Quarterly measurement.
DATUM.--Elevation of land-surface datum is 860 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.00 ft above land-surface datum.
PERIOD OF RECORD.--December 1964 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 111.51 ft below land-surface datum, Mar. 20, 1978; lowest measured, 122.02 ft below land-surface datum, Mar. 5, 1965.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 27	116.02	JAN 18	116.25	APR 12	116.40	JUL 7	115.91	SEP 27	115.96

BAY COUNTY

435128083582401. Local number, 17N 4E 22DCAA.
LOCATION.--Lat 43°51'28", long 83°58'24", Hydrologic Unit 04080102, at end of Second Street in Pinconning. Owner: Pinconning Township.
AQUIFER.--Saginaw Formation of Pennsylvanian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 110 ft, cased to 60 ft, open bottom.
INSTRUMENTATION.--Monthly measurement. Water-level recorder from August 1962 to October 1979.
DATUM.--Elevation of land-surface datum is 620 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood shelter base, 2.00 ft above land-surface datum.
REMARKS.--Water levels affected by regional pumping.
PERIOD OF RECORD.--August 1962 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 0.05 ft below land-surface datum, Mar. 5, 1976; lowest recorded, 10.53 ft below land-surface datum, Aug. 8, 1963.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 11	4.13	DEC 19	2.48	MAR 10	2.42	JUN 1	2.72	JUL 5	2.95	AUG 24	4.98
NOV 16	3.04	JAN 20	2.48	APR 14	2.36						

BRANCH COUNTY

415602084593701. Local number, 6S 6W 22CABA.
LOCATION.--Lat 41°56'02", long 84°59'37", Hydrologic Unit 04050001, at Bennett and Tibbits Streets in Coldwater. Owner: City of Coldwater.
AQUIFER.--Sand and gravel of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 113 ft, screened 108 to 113 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 970 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood shelter base, 2.50 ft above land-surface datum.
REMARKS.--Water levels affected by nearby pumping.
PERIOD OF RECORD.--January 1964 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 8.77 ft below land-surface datum, June 4, 1989; lowest recorded, 25.9 ft below land-surface datum, May 25, 1977.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	23.78	23.10	21.43	17.21	11.83	12.16	15.34	20.75	11.74	21.37	12.82	21.27
10	23.94	19.07	16.25	13.57	12.01	22.01	22.17	15.35	10.14	20.65	21.06	17.90
15	22.98	17.09	13.93	11.88	12.23	17.60	14.75	12.16	15.44	20.20	22.78	23.48
20	22.85	16.49	14.01	12.04	18.84	21.75	12.77	12.25	13.70	21.44	13.03	17.08
25	20.24	16.31	12.43	20.03	12.15	12.03	16.94	13.68	19.24	20.75	18.17	16.24
EOM	23.17	21.00	12.16	14.93	14.95	17.22	20.21	20.22	11.37	20.82	15.29	16.52

WTR YR 1989 HIGHEST 8.77 JUN 4 LOWEST 24.58 OCT 19

CALHOUN COUNTY

422422085071501. Local number, 1S 7W 10BBAB.
LOCATION.--Lat 42°24'22", long 85°07'15", Hydrologic Unit 04050003, at State Highways 78 and 66, 5 mi north of Battle Creek. Owner: Rilla Sabin.
AQUIFER.--Glacial deposits of Pleistocene age.
WELL CHARACTERISTICS.--Dug water-table well, diameter 1.25 in., depth 12 ft, screened 9 to 12 feet.
INSTRUMENTATION.--Weekly measurement by observer.
DATUM.--Elevation of land-surface datum is 970.99 ft above National Geodetic Vertical Datum of 1929. Measuring point: Top of casing, 1.50 ft above land-surface datum.
PERIOD OF RECORD.--September 1946 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 0.89 ft below land-surface datum, Mar. 28, 1950; lowest, dry, July 29, 1964.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 5	4.47	DEC 7	4.34	FEB 1	3.80	APR 5	3.60	JUN 7	3.86	SEP 6	4.33
12	4.46	14	4.26	8	3.82	12	3.68	14	3.80	13	4.32
19	4.46	21	4.20	15	3.84	19	3.80	21	3.75	20	4.34
26	4.44	28	3.92	22	3.88	26	3.94	28	3.72	27	4.35
NOV 2	4.44	JAN 4	3.88	MAR 1	3.85	MAY 2	3.96	AUG 2	3.50		
9	4.42	11	3.83	8	3.76	9	3.94	23	4.30		
16	4.43	18	3.80	15	3.74	16	3.92	30	4.35		
23	4.43	25	3.77	22	3.62	22	3.92				
30	4.44			29	3.52	29	3.90				

CALHOUN COUNTY--Continued

422025085084001. Local number, 1S 7W 32DABA.
LOCATION.--Lat 42°20'25", long 85°08'40", Hydrologic Unit 04050003, at Verona well field in Battle Creek. Owner: City of Battle Creek.
AQUIFER.--Marshall Formation of Mississippian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 8 in., depth 127 ft, cased to 103 ft.
INSTRUMENTATION.--Daily measurement by observer.
DATUM.--Elevation of land-surface datum is 830.79 ft above National Geodetic Vertical Datum of 1929. Measuring point: Recorder base, 2.10 ft above land-surface datum.
REMARKS.--Water levels affected by nearby municipal pumping.
PERIOD OF RECORD.--October 1939 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 0.7 ft below land-surface datum, Apr. 26, 27, 1950; lowest measured, 16.75 ft below land-surface datum, July 16, 1959.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	10.10	11.00	9.20	8.80	8.90	9.60	9.20	9.70	9.30	8.50	9.60	9.50
10	9.80	10.40	9.20	9.40	9.20	9.35	8.90	9.40	9.20	8.60	9.80	9.30
15	10.40	10.15	9.80	8.60	9.10	8.70	9.00	10.00	8.50	8.90	9.60	9.50
20	10.50	9.90	9.40	9.20	9.10	8.20	9.35	9.75	8.80	9.20	9.70	9.60
25	10.60	9.00	8.65	8.50	9.50	8.20	9.80	10.10	8.00	9.80	9.85	9.70
EOM	11.20	10.10	8.80	9.20	9.50	8.10	8.70	8.60	8.60	9.50	9.98	9.50

CASS COUNTY

414651085575601. Local number, 8S 14W 17BAAA.
LOCATION.--Lat 41°46'51", long 85°57'56", Hydrologic Unit 04050001, at U.S. Highway 112, 2 mi east of Adamsville. Owner: Ted Little.
AQUIFER.--Glacial deposits of Pleistocene age.
WELL CHARACTERISTICS.--Dug water-table well, diameter 28 in., depth 55 ft, cribbed with brick to open bottom.
INSTRUMENTATION.--Monthly measurement by observer.
DATUM.--Elevation of land-surface datum is 840 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of wooden platform, 0.80 ft above land-surface datum.
PERIOD OF RECORD.--September 1945 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 46.20 ft below land-surface datum, July 16, 1950; lowest measured, dry, Mar. 10, 1947, Jan. 23, Feb. 24, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 23	53.00	DEC 21	52.30	FEB 22	51.40	APR 24	52.40	JUN 23	51.90	AUG 22	51.90
NOV 23	52.60	JAN 24	53.20	MAR 22	52.50	MAY 24	52.20	JUL 22	52.00	SEP 25	52.10

CHEBOYGAN COUNTY

454427084424001. Local number, 39N 3W 29CBCB1.
LOCATION.--Lat 45°44'27", long 84°42'40", Hydrologic Unit 04070003, at Stimpson Road, 3 mi southeast of Mackinaw City. Owner: U.S. Geological Survey.
AQUIFER.--Dundee Formation of Devonian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 121 ft, cased to 104 ft, open bottom.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 705 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.00 ft above land-surface datum.
PERIOD OF RECORD.--January 1979 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 4.71 ft below land-surface datum, Apr. 8, 1986; lowest measured, 11.68 ft below land-surface datum, Feb. 11, 1981.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 5	9.39	DEC 23	6.09	MAR 17	6.74	JUN 7	6.07	JUL 20	7.99	AUG 30	9.55
NOV 9	5.97	JAN 30	6.72	APR 25	5.33						

CHEBOYGAN COUNTY--Continued

454427084424002. Local number, 39N 3W 29CBCB2.
LOCATION.-- Lat 45°44'27", long 84°42'40", Hydrologic Unit 04070003, at Stimpson Road, 3 mi southeast of Mackinaw City. Owner: U.S. Geological Survey.
AQUIFER.--Sand and gravel of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 55 ft, screened 40 to 55 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 705 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.5 ft above land-surface datum.
PERIOD OF RECORD.--February 1979 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 1.80 ft below land-surface datum, Apr. 8, 1986; lowest measured, 6.47 ft below land-surface datum, Feb. 11, 1982.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 5	4.93	DEC 23	2.58	MAR 17	2.86	JUN 7	2.68	JUL 20	4.35	AUG 30	5.44
NOV 9	2.77	JAN 30	2.95	APR 25	2.25						

CHIPPEWA COUNTY

462159084442201. Local number, 46N 4W 24DADA.
LOCATION.--Lat 46°21'59", long 84°44'22", Hydrologic Unit 04020203, on trail 0.2 mi south of State Highway 28, 1 mi west of Raco. Owner: U.S. Forest Service.
AQUIFER.--Glacial deposits of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 54 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 850 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of shelter base, 3.07 ft above land-surface datum.
PERIOD OF RECORD.--June 1952 to April 1965. November 1969 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 18.40 ft below land-surface datum, June 7, 1971; lowest recorded, 28.43 ft below land-surface datum, Apr. 14, 1964.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	26.81	27.04	25.41	24.81	25.13	25.61	25.99	24.62	23.82	24.17	24.74	25.23
10	26.88	26.84	25.24	24.86	25.21	25.66	26.00	24.32	23.85	24.27	24.83	25.31
15	26.94	26.39	25.09	24.84	25.35	25.74	25.89	24.10	23.87	24.40	24.90	25.40
20	27.00	26.03	24.96	24.92	25.39	25.80	25.75	23.95	23.93	24.49	24.97	25.48
25	27.05	25.77	24.89	24.98	25.45	25.87	25.48	23.88	23.99	24.58	25.05	25.56
EOM	27.09	25.58	24.85	25.01	25.52	25.94	25.07	23.83	24.07	24.67	25.14	25.64

WTR YR 1989 HIGHEST 23.80 JUN 5, 6 LOWEST 27.09 OCT 30, 31

CLINTON COUNTY

425410084323501. Local number, 6N 2W 16DDAD.
LOCATION.--Lat 42°54'10", long 84°32'35", Hydrologic Unit 04050005, at U.S. Highway 27, 6 mi south of St. Johns. Owner: Michigan Department of Transportation.
AQUIFER.--Gravel of Pleistocene age.
WELL CHARACTERISTICS.--Driven water-table well, diameter 2 in., depth 26 ft, screened 23 to 26 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 803.32 ft above National Geodetic Vertical Datum of 1929. Measuring point: Top of casing, 0.10 ft below land-surface datum.
REMARKS.--Federal key well. Measuring point changed from 1.30 ft above land-surface datum to 0.10 ft below land-surface datum on Sept. 23, 1980.
PERIOD OF RECORD.--August 1948 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 13.84 ft below land-surface datum, Apr. 30, 1974; lowest measured, 19.93 ft below land-surface datum, Feb. 27, 1964.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 25	17.46	DEC 28	16.31	FEB 27	16.65	APR 26	16.08	JUN 28	15.53	AUG 25	16.98
NOV 29	16.22	JAN 27	16.43	MAR 29	16.48	MAY 30	16.67	JUL 26	16.58	SEP 28	16.84

CRAWFORD COUNTY

443308084245001. Local number, 25N 1W 15DDCD.
LOCATION.--Lat 44°33'08", long 84°24'50", Hydrologic Unit 04070007, at State Highway 18, 2.6 mi south of Eldorado. Owner: U.S. Forest Service.
AQUIFER.--Glacial deposits of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 56 ft, cased.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 1,190 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of shelter base, 2.95 ft above land-surface datum.
PERIOD OF RECORD.--November 1948 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 25.55 ft below land-surface datum, Nov. 10, 1986; lowest recorded, 35.97 ft below land-surface datum Apr. 4-6, 1951.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	28.66	28.94	28.63	28.11	28.14	28.39	28.03	27.84	27.90	28.11	28.28	28.53
10	28.70	28.98	28.50	28.09	28.16	28.45	28.00	27.86	27.93	28.13	28.34	28.56
15	28.76	29.01	28.36	28.06	28.22	28.47	27.95	27.85	27.96	28.17	28.37	28.61
20	28.81	28.99	28.28	28.06	28.27	28.52	27.92	27.85	28.01	28.19	28.40	28.65
25	28.85	28.89	28.21	28.09	28.31	28.55	27.89	27.84	28.04	28.24	28.44	28.69
EOM	28.92	28.73	28.14	28.08	28.33	28.23	27.87	27.88	28.08	28.27	28.48	28.74

WTR YR 1989 HIGHEST 27.83 MAY 5, 6, 25, 26 LOWEST 29.01 NOV 14, 15, 16

DELTA COUNTY

454446087090401. Local number, 39N 23W 28ACCC.
LOCATION.--Lat 45°44'46", long 87°09'04", Hydrologic Unit 04030111, 3.5 mi west of Escanaba. Owner: M. Blake.
AQUIFER.--Munising Sandstone of Cambrian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 5 in., depth 530 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 680 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of shelter base, 3.39 ft above land-surface datum.
PERIOD OF RECORD.--July 1968 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 1.5 ft below land-surface datum, May 6, 1960; lowest recorded, 8.9 ft below land-surface datum, Feb. 6, 1977.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	7.42	6.58	6.20	6.15	6.39	6.55	6.09	5.74	5.82	6.50	6.43	7.38
10	7.42	6.36	6.11	6.21	6.31	6.46	5.95	5.99	5.78	8.16	6.90	7.15
15	7.42	6.22	6.19	6.26	6.53	6.44	5.76	6.26	5.81	7.70	6.54	7.33
20	7.31	6.15	6.23	6.40	6.35	6.74	5.82	6.02	6.30	6.31	6.91	7.53
25	6.94	6.12	6.11	6.38	6.35	6.50	5.84	5.79	5.63	7.12	7.02	7.74
EOM	6.93	5.95	6.11	6.18	6.43	5.92	5.91	5.85	5.75	6.72	7.14	8.30

WTR YR 1989 HIGHEST 5.28 JUN 23 LOWEST 8.44 SEP 19

DICKINSON COUNTY

460458087493901. Local number, 43N 28W 32ADAB.
LOCATION.--Lat 46°04'58", long 87°49'39", Hydrologic Unit 04030109, 6.25 mi north of Felch. Owner: Michigan Department of Natural Resources.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Augered water-table well, diameter 1.25 in., depth 31 ft, screened 29 to 31 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 1,160 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Hole in top of cap, 4.00 ft above land-surface datum.
REMARKS.--Water temperature also measured.
PERIOD OF RECORD.--October 1966 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 12.95 ft below land-surface datum, Apr. 9, 1966; lowest measured, 16.50 ft below land-surface datum, Mar. 2, 1977.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 3	15.61	DEC 5	14.63	FEB 2	15.13	APR 5	14.98	JUL 6	14.44	SEP 5	15.25
30	15.34	JAN 5	14.90	MAR 1	15.34	JUN 1	14.55	AUG 2	14.97		

EATON COUNTY

424435084365001. Local number, 4N 3W 12CDAD.
LOCATION.--Lat 42°44'35", long 84°36'50", Hydrologic Unit 04050004, at Robins Road, in Delta Township, 0.5 mi west of Lansing. Owner: F. Wheeler.
AQUIFER.--Saginaw Formation of Pennsylvanian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 381 ft, cased to 140 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 862.91 ft above National Geodetic Vertical Datum of 1929. Measuring point: Plywood instrument shelf, 1.00 ft above land-surface datum.
REMARKS.--Water levels affected by pumping.
PERIOD OF RECORD.--October 1953 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 65.68 ft below land-surface datum, Apr. 24, 1989; lowest recorded, 103.6 ft below land-surface datum, Aug. 28, 1969.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	70.62	73.31	75.14	69.41	72.60	72.18	68.23	72.41	73.32	77.39	83.16	73.00
10	69.51	70.18	75.62	70.50	70.92	72.59	68.17	73.40	74.74	80.05	77.06	71.57
15	70.11	69.23	76.71	71.36	71.96	73.64	68.06	72.61	73.01	83.11	76.71	71.39
20	69.47	68.69	76.34	73.38	71.65	72.83	67.10	75.46	74.47	85.10	75.94	70.93
25	69.70	71.72	71.99	72.23	71.56	72.55	66.55	75.78	75.37	82.21	74.42	70.73
EOM	74.23	70.55	67.93	71.42	71.53	70.83	70.09	74.68	74.96	79.47	74.23	68.39

WTR YR 1989 HIGHEST 65.68 APR 24 LOWEST 85.62 JUL 19

GENESEE COUNTY

425552083382801. Local number, 6N 7E 9DCCC.
LOCATION.--Lat 42°55'52", long 83°38'28", Hydrologic Unit 04080204, at Fisher Body Plant in Grand Blanc. Owner: General Motors Corporation.
AQUIFER.--Saginaw Formation of Pennsylvanian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 10 in., depth 385 ft, cased to 150 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 837.0 ft above National Geodetic Vertical Datum of 1929. Measuring point: Instrument shelf, 1.50 ft above land-surface datum.
REMARKS.--Water levels affected by nearby pumping. Measurements made by Plant Water Department.
PERIOD OF RECORD.--January 1974 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 52.3 ft below land-surface datum, Dec. 29, 1975; lowest recorded, 87.74 ft below land-surface datum, July 9, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	67.69	63.91	62.90	65.03	62.27	61.42	62.74	66.20	65.70	61.99	---	69.19
10	65.86	63.08	63.34	---	63.23	---	63.11	66.50	66.55	61.99	---	68.59
15	66.77	62.73	65.34	---	63.51	---	63.55	67.66	64.67	66.34	---	66.15
20	63.87	62.08	64.61	---	62.02	---	64.02	70.30	63.69	69.01	---	63.72
25	63.97	62.19	64.47	63.80	61.78	---	63.66	66.94	64.04	66.62	---	64.36
EOM	65.76	62.09	61.26	62.84	61.58	---	64.85	67.80	61.84	68.61	---	65.26

WTR YR 1989 HIGHEST 60.21 FEB 27 LOWEST 70.30 MAY 20

GRAND TRAVERSE COUNTY

443921085213501. Local number, 26N 9W 14ABAA.
LOCATION.--Lat 44°39'21", long 85°21'35", Hydrologic Unit 04060105, 5.5 mi north of Fife Lake. Owner: U.S. Geological Survey.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 80 ft, PVC pipe and screen.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 960 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood instrument shelf, 2.85 ft above land-surface datum.
PERIOD OF RECORD.--June 1976 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 21.32 ft below land-surface datum, Oct. 22, 26, 27, 1986; lowest recorded, 28.05 ft below land-surface datum, Apr. 3, 1982.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	25.24	25.50	24.42	24.03	24.35	24.60	24.68	23.98	24.16	23.99	24.07	24.43
10	25.28	25.48	24.28	24.12	24.39	24.64	24.55	23.99	24.18	23.99	24.16	24.49
15	25.34	25.25	24.20	24.11	24.46	24.69	24.37	24.00	24.12	23.99	24.19	24.55
20	25.40	25.00	24.12	24.21	24.47	24.73	24.21	24.03	24.07	24.00	24.24	24.61
25	25.45	24.79	24.08	24.25	24.50	24.78	24.09	24.06	24.02	24.03	24.31	24.67
EOM	25.50	24.59	24.05	24.27	24.54	24.75	24.01	24.13	24.00	24.06	24.37	24.73

WTR YR 1989 HIGHEST 23.96 MAY 4, 5, 12, JUL 9, 10 LOWEST 25.53 NOV 7-9

HILLSDALE COUNTY

415154084315401. Local number, 7S 2W 15BCBA1.
LOCATION.--Lat 41°51'54", long 84°31'54", Hydrologic Unit 04100003, on Trail Road, 7 mi southeast of Hillsdale. Owner: U.S. Geological Survey.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 150 ft, screened 135 to 150 ft.
INSTRUMENTATION.--Water-level recorder. Monthly measurement prior to Sept. 30, 1988.
DATUM.--Elevation of land-surface datum is 1,092 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.50 ft above land-surface datum.
PERIOD OF RECORD.--November 1978 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 46.14 ft below land-surface datum, Apr. 13, 1982; lowest recorded, 49.49 ft below land-surface datum, Oct. 30, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	49.40	49.02	49.28	49.08	49.04	48.90	48.65	48.41	48.22	48.22	48.23	48.62
10	49.24	49.31	49.18	49.12	48.91	49.00	48.75	48.54	48.22	48.18	48.48	48.51
15	49.32	49.36	49.26	48.93	49.00	48.79	48.54	48.50	48.09	48.28	48.42	48.52
20	49.35	49.24	49.06	49.06	48.80	48.90	48.60	48.45	48.15	48.17	48.46	48.58
25	49.25	49.19	49.21	49.00	48.93	48.74	48.50	48.41	48.18	48.40	48.53	48.67
EOM	49.49	49.15	49.05	48.77	48.80	48.66	48.58	48.34	48.28	48.32	48.52	48.61

WTR YR 1989 HIGHEST 48.01 JUN 13 LOWEST 49.49 OCT 30

415236084313701. Local number, 7S 2W 10BDDD.
LOCATION.--Lat 41°52'36", long 84°31'37", Hydrologic Unit 04100003, at State Highway 34, 2.5 mi west of Pittsford. Owner: Michigan Department of Natural Resources.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Augered water-table well, diameter 1.25 in., depth 20 ft, screened 17 to 20 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 1,070 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 4.00 ft above land-surface datum.
PERIOD OF RECORD.--December 1965 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 5.79 ft below land-surface datum, Apr. 13, 1982; lowest measured, 11.1 ft below land-surface datum, Sept. 21, 1967.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 1	8.56	JAN 24	7.99	APR 17	7.59	MAY 30	7.96	JUL 11	8.11	AUG 22	8.80
DEC 12	7.98	MAR 7	8.31								

INGHAM COUNTY

424424084340301. Local number, 4N 2W 17ABAA.
LOCATION.--Lat 42°44'24", long 84°34'03", Hydrologic Unit 04050004, at Kirby and Logan Streets in Lansing. Owner: City of Lansing.
AQUIFER.--Saginaw Formation of Pennsylvanian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 20 in., depth 424 ft.
INSTRUMENTATION.--Water-level recorder. Monthly measurement prior to August 1960.
DATUM.--Elevation of land-surface datum is 858.72 ft above National Geodetic Vertical Datum of 1929. Measuring point: Plywood shelter base, 0.5 ft above land-surface datum.
REMARKS.--Water levels affected by regional pumping.
PERIOD OF RECORD.--December 1929 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 34.3 ft below land-surface datum, December 1929; lowest recorded, 168.3 ft below land-surface datum, May 7, 1968.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	74.38	71.51	69.79	67.23	65.96	64.77	63.25	62.39	63.44	64.40	64.70	64.36
10	73.53	71.85	69.29	67.30	65.52	64.76	63.42	62.78	63.84	64.45	65.02	63.99
15	73.41	71.61	69.14	66.66	65.53	64.21	62.93	62.73	63.72	64.84	64.65	63.86
20	73.32	70.91	68.30	66.82	64.84	64.14	62.97	62.85	64.08	64.76	64.52	63.63
25	72.64	70.44	68.47	66.47	64.93	63.82	62.64	62.78	64.16	65.15	64.63	63.34
EOM	72.92	69.85	67.78	65.51	64.61	63.37	62.88	63.35	64.48	65.02	64.39	63.07

WTR YR 1989 HIGHEST 62.14 MAY 5 LOWEST 74.45 OCT 6

IOSCO COUNTY

442839083312301. Local number, 24N 7E 13ADAD1.
LOCATION.--Lat 44°28'39", long 83°31'23", Hydrologic Unit 04070007, 10 mi west of Oscoda. Owner: U.S. Geological Survey.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 69 ft, screened 54 to 69 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 760 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.00 ft above land-surface datum.
PERIOD OF RECORD.--June 1980 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 25.49 ft below land-surface datum, Sept. 25, 1986; lowest measured, 32.71 ft below land-surface datum, Mar. 23, 1982.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 3	29.70	MAR 8	30.80	MAY 2	30.28	JUN 12	30.17	JUL 27	30.46	AUG 23	30.66
DEC 8	30.31	APR 15	30.35								

IRON COUNTY

461257088542001. Local number, 44N 37W 14BBCA.
LOCATION.--Lat 46°12'57", long 88°54'20", Hydrologic Unit 04030106, at Federal Forest Highway 16, 0.5 mi south of Elmwood. Owner: Michigan Department of Transportation.
AQUIFER.--Sand and gravel of Pleistocene age.
WELL CHARACTERISTICS.--Driven water-table well, diameter 6 in., depth 102 ft.
INSTRUMENTATION.--Quarterly measurement.
DATUM.--Elevation of land-surface datum is 1,730 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of plywood shelter base, 4.21 ft above land-surface datum.
PERIOD OF RECORD.--October 1959 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 90.57 ft below land-surface datum, Sept 25, 1986; lowest measured, 97.11 ft below land-surface datum, Aug. 16, 1982.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 27	93.29	JAN 20	93.00	MAY 19	93.00	AUG 4	92.86

JACKSON COUNTY

421346084230801. Local number, 3S 1W 11AADD1.
LOCATION.--Lat 42°13'46", long 84°23'08", Hydrologic Unit 04050004, at Belden and Mansion Streets in Jackson. Owner: City of Jackson.
AQUIFER.--Saginaw Formation of Pennsylvanian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 16 in., depth 360 ft, open bottom.
INSTRUMENTATION.--Daily measurement by observer; lowest monthly reading shown.
DATUM.--Elevation of land-surface datum is 935 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood recorder shelf, 5.50 ft above land-surface datum.
REMARKS.--Water levels affected by pumping.
PERIOD OF RECORD.--June 1957 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 18.6 ft below land-surface datum, Jan. 2, 1961; lowest measured, 122.0 ft below land-surface datum, July 8, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 4	85.5	DEC 16	74.7	FEB 1	78.4	APR 28	79.9	JUL 7	86.0	SEP 22	85.2
NOV 3	70.6	JAN 13	74.5	MAR 17	70.5	MAY 2	81.6	AUG 4	87.3		

KALAMAZOO COUNTY

421325085404801. Local number, 3S 12W 11BDAD.

LOCATION.--Lat 42°13'25", long 85°04'48", Hydrologic Unit 04050003, at Kalamazoo Valley Community College. Owner: City of Kalamazoo

AQUIFER.--Glacial deposits of Pleistocene age.

WELL CHARACTERISTICS.--Drilled artesian well, diameter 3 in., depth 248 ft.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 880 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of shelter base, 4.00 ft above land-surface datum.

PERIOD OF RECORD.--March 1961 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, +2.98 ft above land-surface datum, Sept. 4, 1969; lowest recorded, 1.10 ft below land-surface datum, July 14, 15, 1988.

WATER LEVEL, IN FEET ABOVE (+) AND BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	.21	+0.52	+0.16	+0.19	+0.21	+0.18	+0.11	.01	+0.16	---	+0.03	+0.02
10	.19	+0.63	+0.05	+0.06	+0.24	+0.34	.01	.06	+0.10	---	.06	.00
15	.16	+0.75	.12	+0.16	+0.12	+0.23	+0.41	.06	+0.18	---	.18	+0.02
20	.13	+0.82	.00	+0.14	+0.28	+0.30	+0.25	.07	+0.19	---	.18	+0.66
25	.11	+0.31	+0.05	+0.20	+0.22	+0.21	+0.06	.05	---	+0.22	+0.03	+0.57
EOM	.07	+0.18	+0.18	+0.24	+0.20	+0.16	.01	+0.03	---	+0.20	.00	+0.38

WTR YR 1989 HIGHEST +1.00 SEP 24, 25 LOWEST 0.25 AUG 22

KENT COUNTY

425030085434901. Local number, 5N 12W 4DCCD.

LOCATION.--Lat 42°50'30", long 85°43'49", Hydrologic Unit 04050006, 0.4 mi west of Byron Center Road, 2.1 mi north of Byron Center. Owner: City of Wyoming.

AQUIFER.--Sand and gravel of Pleistocene age.

WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 86 ft.

INSTRUMENTATION.--Monthly measurement. Water-level recorder October 1962 to July 1978.

DATUM.--Elevation of land-surface datum is 685.97 ft above National Geodetic Vertical Datum of 1929 Measuring point: Top of shelter base, 2.80 ft above land-surface datum.

PERIOD OF RECORD.--October 1962 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 8.28 ft below land-surface datum, Apr. 14, 1974; lowest recorded, 12.91 ft below land-surface datum, Aug. 19, 1964.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 27	10.64	JAN 18	9.92	APR 12	9.78	JUL 10	10.76	AUG 15	10.45	SEP 27	10.54
DEC 7	9.77	MAR 2	10.32	MAY 25	10.38						

LAKE COUNTY

440737085483701. Local number, 20N 13W 13ACAC1.

LOCATION.--Lat 44°07'37", long 85°48'37", Hydrologic Unit 04060103, 5 mi east of Irons. Owner: U.S. Geological Survey.

AQUIFER.--Outwash deposits of Pleistocene age.

WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 57 ft, screened 42 to 57 ft.

INSTRUMENTATION.--Monthly measurement.

DATUM.--Elevation of land-surface datum is 945 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.00 ft above land-surface datum.

PERIOD OF RECORD.--March 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 9.13 ft below land-surface datum, Oct. 8, Nov. 12, 1986; lowest measured, 17.71 ft below land-surface datum, Mar. 14, 1980.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 13	12.95	JAN 6	11.57	MAR 30	11.75	JUN 22	10.71	AUG 2	11.40	SEP 12	12.02
NOV 23	11.88	FEB 16	12.02	MAY 9	11.07						

LEELANAU COUNTY

445020086012201. Local number, 28N 14W 8DDCA1.
LOCATION.--Lat 44°50'20", long 86°01'22", Hydrologic Unit 04060104, 2.5 mi northeast of Empire. Owner: U.S. Geological Survey.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 138 ft, screened 123 to 138 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 750 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.00 ft above land-surface datum.
PERIOD OF RECORD.--February 1978 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 111.25 ft below land-surface datum, Apr. 7, 1987; lowest measured, 114.49 ft below land-surface datum, June 21, 1983.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 3	111.97	DEC 21	112.27	MAR 14	112.25	JUN 5	112.45	JUL 11	112.56	AUG 22	112.43
NOV 7	112.06	FEB 1	112.33	APR 20	112.45						

445011086031401. Local number, 28N 14W 18BABB1.
LOCATION.--Lat 44°50'11", long 86°03'14", Hydrologic Unit 04060104, 2 mi north of Empire. Owner: U.S. Geological Survey.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 60 ft, screened 45 to 60 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 625 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.00 ft above land-surface datum.
PERIOD OF RECORD.--November 1979 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 20.79 ft below land-surface datum, Oct. 14, 15, 1986; lowest recorded, 24.76 ft below land-surface datum, Sept. 29, 1982.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	23.95	23.92	[illegible]	23.38	23.44	[illegible]	22.93	23.38	23.66	23.23	23.62	23.92
10	23.94	23.71	23.32	23.39	23.51	23.70	22.99	23.46	23.69	23.26	23.68	23.96
15	23.96	23.42	23.40	23.38	23.56	23.73	23.07	23.51	23.71	23.35	23.73	23.99
20	23.98	23.26	23.44	23.41	23.57	23.77	23.17	23.56	23.61	23.42	23.78	24.04
25	23.99	23.19	23.43	23.44	23.62	23.81	23.25	23.60	23.39	23.51	23.83	24.09
EOM	23.98	23.16	23.39	23.42	23.64	[illegible]	23.33	23.65	23.27	23.58	23.87	24.11

WTR YR 1989 HIGHEST [illegible] APR 4, [illegible] LOWEST 24.11 SEP 29, 30

LENAWEE COUNTY

420246084150601. Local number, 5S 1E 11DDB1.
LOCATION.--Lat 42°02'46", long 84°15'06", Hydrologic Unit 04100002, in the Onsted State Game Area, 2 mi west of Cambridge Junction. Owner: Michigan Department of Natural Resources.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 1.25 in., depth 39 ft, screened 36 to 39 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 1,000 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 3.50 ft above land-surface datum.
REMARKS.--Water temperature also measured.
PERIOD OF RECORD.--December 1965 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 15.89 ft below land-surface datum, Mar. 26, 1982; lowest measured, 19.33 ft below land-surface datum, Sept. 2, 1971.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT [illegible]	17.54	DEC 22	16.74	MAR 17	16.63	JUN 9	16.42	JUL 21	17.20	SEP 7	17.14
NOV 18	16.81	FEB 3	16.64	APR 28	16.58						

LIVINGSTON COUNTY

422853083402801. Local number, 1N 6E 13DBAB.
LOCATION.--Lat 42°28'53", long 83°40'28", Hydrologic Unit 04090005, at Twelve Mile Road, 2 mi northwest of South Lyon. Owner: American Aggregate Corporation.
AQUIFER.--Glacial deposits of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 2 in., depth 29 ft, 1.25 in. diameter screen.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 930 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood instrument shelf, 2.50 ft above land-surface datum.
PERIOD OF RECORD.--April 1970 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 12.1 ft below land-surface datum, Apr. 22, 1974; lowest recorded, 21.58 ft below land-surface datum, Oct. 30, 31, Nov. 1, 1979.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	16.10	15.88	15.68	15.99	15.83	16.04	15.77	15.29	15.38	15.10	15.06	15.60
10	16.15	15.75	15.67	15.95	15.90	16.06	15.68	15.45	15.21	15.05	15.19	15.49
15	16.07	15.73	15.88	15.90	15.96	16.08	15.60	15.40	15.30	14.89	15.31	15.41
20	15.95	15.66	15.98	15.90	15.98	15.97	15.54	15.28	15.39	14.87	15.37	15.49
25	15.95	15.67	16.00	15.90	16.00	15.94	15.43	15.34	15.01	15.19	15.35	15.58
EOM	15.99	15.73	16.00	15.85	16.00	15.84	15.38	15.50	14.80	15.12	15.42	15.56

WTR YR 1989 HIGHEST 14.76 JUN 30, JUL 1 LOWEST 16.24 OCT 17

MACKINAC COUNTY

460321084354801. Local number, 42N 2W 7AABB.
LOCATION.--Lat 46°03'21", long 84°35'48", Hydrologic Unit 04070002, at Pontchartrain and St. Ignace Roads, 2 mi north of Pontchartrain Shores. Owner: U.S. Forest Service.
AQUIFER.--Manistique Dolomite of Silurian age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 102 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 650 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of shelter floor, 2.30 ft above land-surface datum.
PERIOD OF RECORD.--June 1958 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 12.49 ft below land-surface datum, Apr. 21, 1985; lowest recorded, [illegible] ft below land-surface datum, Feb. 7, 1977.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	26.95	23.79	20.75	23.71	25.06	26.40	17.25	22.44	23.05	24.90	---	28.83
10	27.03	17.66	21.72	23.80	25.15	26.57	17.08	22.13	23.54	25.23	---	29.00
15	26.00	19.34	22.46	23.93	25.61	26.62	17.34	22.62	23.73	26.50	---	29.24
20	24.57	19.12	22.98	24.44	25.68	26.69	18.05	23.05	23.79	26.90	---	29.46
25	24.01	20.28	22.82	24.72	25.92	26.65	19.63	23.32	24.09	---	---	29.67
EOM	23.60	19.57	23.22	24.79	26.04	20.36	20.84	23.12	24.52	---	28.49	29.90

WTR YR 1989 HIGHEST 15.95 NOV 6 LOWEST 29.90 SEP 30

MARQUETTE COUNTY

462938087475901. Local number, 47N 28W 30CDC.
LOCATION.--Lat 46°29'38", long 87°47'59", Hydrologic Unit 04020105, on U.S. Highway 41 and State Highway 28, and 4.8 mi west of Ishpeming. Owner: Ely Township.
AQUIFER.--Sand and gravel of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 8 in., depth 72 ft, screened 69 to 72 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is [illegible] ft above National Geodetic Vertical Datum of 1929. Measuring point: Top of recorder base, 3.00 ft above land-surface datum.
REMARKS.--Federal key well.
PERIOD OF RECORD.--August 1961 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 9.42 ft below land-surface datum, Apr. 21, 1985; lowest recorded, 19.26 ft below land-surface datum, Apr. 10, 11, 1964.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	14.28	13.24	11.75	12.52	13.24	13.91	13.18	12.48	12.64	11.71	12.71	13.55
10	13.97	12.65	11.95	12.68	13.34	13.99	12.63	12.53	12.03	11.90	12.91	13.61
15	13.96	12.57	12.09	12.75	13.52	14.09	12.78	12.54	11.54	12.07	13.05	13.73
20	13.98	11.81	12.19	12.92	13.57	14.21	12.55	12.59	11.37	12.24	13.17	13.84
25	13.84	11.92	12.32	13.01	13.67	14.29	12.46	12.57	11.45	12.41	13.29	13.97
EOM	13.39	11.77	12.43	13.12	13.77	13.40	12.48	12.59	11.55	12.58	13.43	14.11

WTR YR 1989 HIGHEST 11.29 JUN 17 LOWEST 14.29 OCT 4, MAR 25, 26

MENOMINEE COUNTY

453504087331301. Local number, 37N 26W 19DADA.
LOCATION.--Lat 45°35'04", long 87°33'13", Hydrologic Unit 04030108, at U.S. Highway 41 at Carney. Owner: Michigan Department of Transportation.
AQUIFER.--Trenton Limestone and Black River Formation of Middle Ordovician age.
WELL CHARACTERISTICS.--Water-table well, diameter 4 in., depth 17 ft, cased.
INSTRUMENTATION.--Quarterly measurement.
DATUM.--Elevation of land-surface datum is 800 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of 2 in. reducing nipple, 1.26 ft above land-surface datum.
REMARKS.--Water temperature also measured.
PERIOD OF RECORD.--September 1959 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 3.32 ft below land-surface datum, Mar. 31, 1986; lowest measured, 8.62 ft below land-surface datum, Jan. 17, 1977.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 27	5.46	MAR 23	5.04	MAY 19	4.79	AUG 3	5.63

MONROE COUNTY

415206083414401. Local number, 7S 6E 15ACAA.
LOCATION.--Lat 41°52'06", long 83°41'44", Hydrologic Unit 04100002, at Teal Road, 2 mi southeast of Petersburg. Owner: U.S. Geological Survey.
AQUIFER.--Detroit River Group of Devonian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 72 ft, cased to 53 ft, open bottom.
INSTRUMENTATION.--Water-level recorder. Monthly measurement prior to Sept. 30, 1988.
DATUM.--Elevation of land-surface datum is 680 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.50 ft above land-surface datum.
PERIOD OF RECORD.--November 1978 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 32.30 ft below land-surface datum, Mar. 26, 1982; lowest recorded, 46.54 ft below land-surface datum, July 9, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	42.84	42.41	41.35	40.75	40.14	40.04	39.90	39.75	39.84	39.14	39.63	40.13
10	42.71	42.41	41.15	40.46	40.08	40.43	39.94	39.84	39.79	39.14	39.50	40.23
15	42.75	41.93	41.17	40.45	40.13	40.05	39.81	39.87	39.38	39.14	40.13	40.04
20	42.55	41.60	41.01	40.45	40.12	40.43	39.82	40.03	39.37	40.94	40.13	40.04
25	42.26	41.46	41.17	40.45	40.04	40.32	39.76	40.13	39.14	41.11	40.13	
EOM	42.42	41.15	40.88	40.13	40.04	40.03	39.90	40.13	39.13	40.13	40.13	

WTR YR 1989 HIGHEST 39.08 JUN 28 LOWEST 42.93 OCT 1

415235083414001. Local number, 7S 6E 15ADBB.
LOCATION.--Lat 41°52'35", long 83°41'40", Hydrologic Unit 04100002, at Teal Road, 1.5 mi southeast of Petersburg. Owner: Michigan Department of Natural Resources.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 1.25 in., depth 17 ft, screened 14 to 17 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 675 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 4.00 ft above land-surface datum.
PERIOD OF RECORD.--December 1965 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 3.00 ft below land-surface datum, Feb. 14, 1966; lowest measured, 7.58 ft below land-surface datum, Oct. 6, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 6	7.58	DEC 22	7.05	MAR 16	7.16	JUN 8	6.23	JUL 20	5.93	SEP 6	5.89
NOV 10	7.44	FEB 2	6.97	APR 27	6.72						

OAKLAND COUNTY

425116083321501. Local number, 5N 8E 8ACAC.
LOCATION.--Lat 42°51'16", long 83°32'15", Hydrologic Unit 04080204, at Van Atta Road, 6 mi northeast of Holly. Owner: Michigan Department of Natural Resources.
AQUIFER.--Sand and gravel of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 1.25 in., depth 42 ft, screened 39 to 42 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 930 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 3.00 ft above land-surface datum.
PERIOD OF RECORD.--November 1965 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 22.30 ft below land-surface datum, Apr. 24, 1974; lowest measured, 26.48 ft below land-surface datum, Sept. 9, 1966.

WATER LEVEL IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 18	26.01	JAN 12	25.33	APR 6	25.10	JUN 28	25.03	AUG 1	25.73	SEP 21	25.93
NOV 30	25.39	FEB 22	25.53	MAY 17	25.29						

OCEANA COUNTY

433133086082601. Local number, 13N 15W 18AAAA.
LOCATION.--Lat 43°31'33", long 86°08'26", Hydrologic Unit 04060101, 6 mi southwest of Hesperia. Owner: U.S. Geological Survey.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water table well, diameter 6 in., depth 79 ft, screened 59 to 79 ft.
INSTRUMENTATION.--Water-level recorder. Monthly measurements August 1977 to July 1979.
DATUM.--Elevation of land-surface datum is 703 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.50 ft above land-surface datum.
PERIOD OF RECORD.--August 1977 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 35.76 ft below land-surface datum, Dec. 2, 3, 1986; lowest recorded, 40.99 ft below land surface datum, Mar. 28, 1982.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	39.61	39.92	39.55	39.12	38.84	38.71	38.66	38.37	38.20	37.85	37.85	38.23
10	39.65	39.99	39.45	39.09	38.90	38.72	38.65	38.33	38.18	37.82	37.94	38.29
15	39.70	40.01	39.40	39.02	38.79	38.74	38.59	38.29	38.13	37.79	37.98	38.36
20	39.75	39.92	39.30	38.99	38.74	38.74	38.55	38.26	38.07	37.78	38.04	38.41
25	39.81	39.79	39.25	38.94	38.71	38.75	38.46	38.24	37.99	37.81	38.11	38.47
EOM	39.88	39.65	39.18	38.86	38.71	38.68	38.42	38.22	37.92	37.82	38.17	38.53

WTR YR 1989 HIGHEST 37.78 JUL 17-21, 27 LOWEST 40.01 NOV 11-15

OGEMAW COUNTY

442514084164702. Local number, 23N 1E 2BAAA.
LOCATION.--Lat 44°25'14", long 84°16'47", Hydrologic Unit [illegible], at south side of Rose City Road, and 8 mi west of Rose City. Owner: Ogemaw County Road Commission.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water table well, diameter 1.25 in., depth 20 ft.
INSTRUMENTATION.--Quarterly measurement.
DATUM.--Elevation of land surface datum is 1,265 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.30 ft above land surface datum.
PERIOD OF RECORD.--November 1966 to October 1971, April 1974 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 7.62 ft below land surface datum, Apr. 13, 1976; lowest measured, 12.6 ft below land surface datum, December 1972.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 27	12.41	MAR 10	12.20	MAY 2	10.53	JUL 13	11.26

GROUND-WATER LEVELS

ONTONAGON COUNTY

465002089321601. Local number, 51N 41W 8BDBC.
LOCATION.--Lat 46°50'02", long 89°32'16", Hydrologic Unit 04020101, 325 ft south of State Highway 64, 1.5 mi east of Silver City. Owner: Michigan Department of Corrections.
AQUIFER.--Freda Sandstone of Keweenawan age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 100 ft, cased to 32 ft.
INSTRUMENTATION.--Quarterly measurement.
DATUM.--Elevation of land-surface datum is 620 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood instrument shelf, 3.50 ft above land-surface datum.
PERIOD OF RECORD.--October 1958 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 8.20 ft below land-surface datum, Apr. 15, 1959; lowest measured, 21.82 ft below land-surface datum, Dec. 15, 1976.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 26	17.19	JAN 18	14.41	MAY 17	9.29	AUG 3	12.77

OTSEGO COUNTY

445920084425801. Local number, 30N 3W [illegible].
LOCATION.--Lat 44°59'20", long 84°4[illegible]'5[illegible]", Hydrologic Unit [illegible], at Old Alba Road, 3 mi southwest of Gaylord. Owner: U.S. Geological Survey.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter [illegible] in., depth 87 ft, screened 72 to 87 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land surface datum is [illegible] ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, [illegible] ft above land surface datum.
PERIOD OF RECORD.--January 1979 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, [illegible] ft below land surface datum, Dec. 10, 1986; lowest measured, 35.62 ft below land surface datum, Apr. 1, [illegible].

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 5	32.88	DEC 22	[illegible]	MAR [illegible]	[illegible]	JUN [illegible]	31.6[illegible]	JUL [illegible]	31.95	AUG 29	32.37
NOV 8	33.18	JAN 31	33.[illegible]	APR [illegible]	32.[illegible]						

PRESQUE ISLE COUNTY

451634083441801. Local number, 33N 6E 8BBBB.
LOCATION.--Lat 45°16'34", long 83°44'18", Hydrologic Unit 04070006, at south side of Grand Lake Highway, and 2 mi west and 1 mi north of Posen. Owner: A. Styma.
AQUIFER.--Traverse Group.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 61 ft.
INSTRUMENTATION.--Quarterly measurement.
DATUM.--Elevation of land surface datum is 815 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 0.50 ft above land surface datum.
PERIOD OF RECORD.--December 1959 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 5.10 ft below land surface datum, Mar. 2, 1979; lowest measured, 16.83 ft below land surface datum, Mar. 5, 1963.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 8	10.55	MAR 9	12.31	MAY 3	8.15	JUL 27	12.84

ROSCOMMON COUNTY

442722084350701. Local number, 24N 2W 20BABA.

LOCATION.--Lat 44°27'22", long 84°35'07", Hydrologic Unit 04070007, at State Highway 103, 2 mi south of Roscommon. Owner: Michigan Department of Natural Resources.

AQUIFER.--Sand of Pleistocene age.

WELL CHARACTERISTICS.--Jetted water-table well, diameter 8 in., depth 14 ft, open bottom.

INSTRUMENTATION.--Water-level recorder.

DATUM.--Elevation of land-surface datum is 1,145.30 ft above National Geodetic Vertical Datum of 1929. Measuring point: Top of casing, 2.50 ft above land-surface datum.

REMARKS.--Federal key well.

PERIOD OF RECORD.--December 1934 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 2.29 ft below land-surface datum, Apr. 19, 1985; lowest recorded, 6.23 ft below land-surface datum, Dec. 6-11, 1949.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	5.19	4.83	3.89	4.27	4.52	4.77	3.54	3.80	4.20	4.29	4.76	5.22
10	5.19	4.31	3.95	4.31	4.56	4.80	3.43	3.90	3.92	4.43	4.87	5.27
15	5.22	4.05	4.04	4.35	4.62	4.59	3.49	3.98	3.88	4.56	4.94	5.30
20	5.04	3.96	4.09	4.41	4.65	4.73	3.53	4.05	3.91	4.65	5.01	5.34
25	4.94	3.94	4.17	4.45	4.69	4.71	3.61	4.11	3.99	4.75	5.07	5.38
EOM	4.87	3.90	4.22	4.48	4.72	3.81	3.72	4.18	4.13	4.86	5.14	5.41

WTR YR 1989 HIGHEST 3.40 APR 8 LOWEST 5.41 SEP 29, 30

SAGINAW COUNTY

431457084194401. Local number, 10N 1E 22DADA1.

LOCATION.--Lat 43°14'57", long 84°19'44", Hydrologic Unit 04080203, at west side of Merrill Road, 0.35 mi north of Marion Springs. Owner: U.S. Geological Survey.

AQUIFER.--Saginaw Formation of Pennsylvanian age.

WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in. depth 210 ft, cased to 170 ft.

INSTRUMENTATION.--Water level recorder.

DATUM.--Elevation of land-surface datum is 657 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood instrument shelf, 2.50 ft above land-surface datum.

PERIOD OF RECORD.--December 1977 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 7.93 ft below land-surface datum, Feb. 10, 1981; lowest recorded, 10.92 ft below land surface datum, Sept. 1, 1988.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	10.56	10.11	10.00	9.68	9.63	9.53	9.43	9.28	9.27	9.23	9.45	9.76
10	10.42	10.16	9.94	9.71	9.50	9.56	9.51	9.40	9.33	9.29	9.60	9.72
15	10.46	10.20	9.92	9.57	9.63	9.44	9.39	9.34	9.27	9.39	9.57	9.75
20	10.44	10.09	9.77	9.68	9.48	9.50	9.45	9.31	9.26	9.36	9.61	9.77
25	10.28	10.05	9.84	9.64	9.50	9.45	9.36	9.26	9.19	9.50	9.66	9.77
EOM	10.44	9.93	9.72	9.40	9.40	9.44	9.41	9.24	9.30	9.53	9.69	9.79

WTR YR 1989 HIGHEST 9.12 JUN 23, 24 LOWEST 10.60 OCT 6

SANILAC COUNTY

433439082523601. Local number, 13N 13E 22ADAA.

LOCATION.--Lat 43°34'39", long 82°52'36", Hydrologic Unit 04090001, at Wheatland Road, 3 mi east and 0.75 mi north of Argyle. Owner: U.S. Geological Survey.

AQUIFER.--Marshall Formation of Mississippian age.

WELL CHARACTERISTICS.--Drilled artesian observation well, diameter 6 in., depth 130 ft, cased with plastic pipe to 48 ft, open bottom.

INSTRUMENTATION.--Water level recorder.

DATUM.--Elevation of land surface datum is 805 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood instrument shelf, 2.50 ft above land surface datum.

PERIOD OF RECORD.--October 1978 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 15.54 ft below land surface datum, Apr 6, 1985; lowest recorded, 22.71 ft below land surface datum, Nov. 20, 1979.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	22.03	21.61	19.69	19.76	19.39	20.01	18.17	18.48	18.13	18.73	20.14	20.94
10	22.01	20.74	19.79	19.50	19.58	20.02	18.26	18.65	17.88	19.11	20.35	20.98
15	22.04	20.10	19.95	19.57	19.76	19.33	18.13	18.39	18.05	19.41	20.49	21.04
20	21.97	19.93	19.98	19.71	19.75	19.18	18.24	18.51	17.60	19.60	20.64	21.04
25	21.82	19.80	19.84	19.71	19.84	18.94	18.33	18.56	17.73	19.81	20.70	21.12
EOM	21.69	19.67	19.68	19.34	19.89	18.41	18.45	18.34	18.25	20.04	20.78	21.28

WTR YR 1989 HIGHEST 17.49 JUN 20, 21 LOWEST 22.11 OCT 1

SCHOOLCRAFT COUNTY

461720085565201. Local number, 45N 13W 16CCCB.
LOCATION.--Lat 46°17'20", long 85°56'52", Hydrologic Unit 04060106, at headquarters building of Seney Wildlife Refuge. Owner: U.S. Fish and Wildlife Service.
AQUIFER.--Limestones of Upper Ordovician age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 4 in., depth 151 ft, cased to 65 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 710 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 3.60 ft below land-surface datum.
PERIOD OF RECORD.--June 1952 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 4.64 ft below land-surface datum, Apr. 13, 1971; lowest recorded, 6.50 ft below land-surface datum, Oct. 23, 1963.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	5.57	5.27	5.30	5.10	5.11	5.03	5.00	5.11	5.09	5.32	5.40	5.54
10	5.53	5.24	5.32	5.11	5.06	5.02	5.14	5.20	5.10	5.39	5.47	5.58
15	5.52	5.32	5.29	5.06	5.11	4.95	5.16	5.19	5.06	5.50	5.46	5.63
20	5.51	5.32	5.18	5.08	5.04	4.97	5.15	5.19	5.07	5.55	5.49	5.67
25	5.35	5.35	5.16	5.10	5.04	4.98	5.16	5.10	5.13	5.65	5.55	5.68
EOM	5.34	5.16	5.14	5.03	5.02	4.99	5.15	5.11	5.24	5.50	5.59	5.73

WTR YR 1989 HIGHEST 4.86 MAR 15 LOWEST 5.73 SEP 26, 27, 29, 30

VAN BUREN COUNTY

421945085481502. Local number, 2S 13W 2BBCB2.
LOCATION.--Lat 42°19'45", long 85°48'15", Hydrologic Unit 04050001, at Fish Lake Road, 2.5 mi north of State Highway 43, and 16 mi east of Bangor. Owner: Van Buren County Road Commission.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 4 in., depth 40 ft, screened 36 to 40 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land surface datum is 737 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 1.00 ft above land surface datum.
PERIOD OF RECORD.--May 1981 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 8.38 ft below land surface datum, Oct. 6, 1986; lowest measured, 12.58 ft below land surface datum, Sept. 19, 1984.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 3	10.82	JAN 26	10.52	APR 19	10.63	JUN 8	10.18	JUL 13	11.39	AUG 24	12.06
DEC 14	10.54	MAR 7	10.91								

WASHTENAW COUNTY

421228083331601. Local number, 3S 7E 24CADB.
LOCATION.--Lat 42°12'28", long 83°33'16", Hydrologic Unit 04090005, at Bridge Street, and at Ypsilanti Township Waterworks. Owner: Ypsilanti Township.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water table well, diameter 4 in., depth 80 ft, screened 77 to 80 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 665.65 ft above National Geodetic Vertical Datum of 1929. Measuring point: Top of coupling, 3.00 ft above land-surface datum.
REMARKS.--Water level affected by nearby pumping.
PERIOD OF RECORD.--July 1943 to June 1945, December 1949 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 5.79 ft below land-surface datum, Jan. 5, 1950; lowest recorded, 22.66 ft below land-surface datum, Feb. 13, 1971.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	14.96	14.45	14.33	14.06	14.48	14.37	13.75	13.77	13.42	13.68	13.83	13.73
10	14.81	14.84	14.31	14.09	14.32	14.45	13.89	13.90	13.64	13.92	13.97	13.75
15	14.80	14.61	14.48	14.09	14.38	14.22	13.81	13.86	13.61	14.12	13.91	13.76
20	14.77	14.34	14.40	14.30	14.20	14.19	13.70	13.94	13.47	14.18	13.92	13.62
25	14.61	14.32	14.45	14.33	14.32	14.01	13.54	13.99	13.54	14.09	13.86	13.63
EOM	14.69	14.23	13.95	14.32	14.31	13.87	13.75	13.79	13.64	13.85	13.88	13.48

WTR YR 1989 HIGHEST 13.33 JUN 22 LOWEST 14.98 OCT 6, 7

TEMPERATURE OF GROUND WATER

Temperatures of ground water are measured as part of a state-wide water resource investigation in cooperation with the Michigan Department of Natural Resources. The purpose of these measurements is to determine the natural ground-water temperature of selected points throughout the State. These data can be used to estimate ground-water temperatures in many areas in the State. Measurements of temperature were made by means of "lazy" thermometers (Heath, 1964).

TEMPERATURE (°C) OF GROUND WATER AT INDICATED DEPTH, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER TEMPERATURE (°C)	DATE	WATER TEMPERATURE (°C)	DATE	WATER TEMPERATURE (°C)
ALGER COUNTY, 45N 19W 25BDCD (LAT 46°16'08", LONG 86°37'38") DEPTH 66 FT					
OCT 19	8.7	MAY 19	7.2	AUG 18	9.2
MAR 8	6.3				
DICKINSON COUNTY, 43N 28W 32ADAB (LAT 46°04'58", LONG 87°49'39") DEPTH 31 FT					
OCT 3	7.5	FEB 2	7.1	JUL 6	5.8
30	7.8	MAR 1	6.7	AUG 2	6.2
DEC 5	8.0	APR 5	6.5	SEP 5	6.5
JAN 5	7.6	JUN 1	5.5		
LENAWEE COUNTY, 5S 1E 12DDBD (LAT 42°02'46", LONG 84°15'06") DEPTH 39 FT					
OCT 7	9.7	FEB 3	10.1	JUN 9	8.8
NOV 14	10.1	MAR 17	9.7	JUL 21	8.7
DEC 23	10.3	APR 28	9.2	SEP 7	9.1
MENOMINEE COUNTY, 37N 26W 19DADA (LAT 45°35'04", LONG 87°33'13") DEPTH 17 FT					
OCT 27	11.5	MAY 19	6.2	AUG 3	9.4
MAR 23	6.0				

DISCONTINUED GAGING STATIONS

The following continuous-record streamflow or stage stations in Michigan have been discontinued or converted to partial-record stations. The column headed "Period of record" shows the water years in which daily streamflow or stage records were collected and published.

Station No.	Station Name	Drainage area (mi²)	Period of record
	STREAMS TRIBUTARY TO LAKE SUPERIOR		
04028000	Montreal River at Ironwood, MI	63.0	1918-22, 1924-26, 1949-54
04030000	Montreal River near Saxon, WI	262	1938-70
04030500	Black River at Ramsay, MI	a82	1924-25
04031000	Black River near Bessemer, MI	200	1955-82
04031500	Presque Isle River at Marenisco, MI	171	1945-82
04032000	Presque Isle River near Tula, MI	261	*1945-73
04032500	Iron River near White Pine, MI	98.1	1952-57
04035000	East Branch Ontonagon River near Mass, MI	272	1942-79
04038000	Cisco Branch Ontonagon River near Watersmeet, MI	62.2	1942-44
04039500	South Branch Ontonagon River at Ewen, MI	348	*1942-71
04041000	Perch River near Sidnaw, MI	63.1	*1913-15
04042000	Sturgeon River near Baraga, MI	379	1927-31, 1943-47
04042500	Otter River near Elo, MI	162	*1942-72
04043000	Sturgeon River near Arnheim, MI	705	1942-74
04043500	Dead River near Negaunee, MI	138	1902-03
04044000	Dead River at Forestville, MI	158	1899-1902
04044400	Carp River near Negaunee, MI	51.4	1961-87
04044500	Carp River near Marquette, MI	a86	1902-04
04044563	Big Creek near Harvey, MI	17.0	1979-81
04044573	Cedar Creek near Harvey, MI	9.04	1979-81
04044583	Cherry Creek near Harvey, MI	4.53	1965-70, 1979-81
04044595	Silver Creek at Harvey, MI	8.58	1979-81
04045000	Tahquamenon River at Newberry, MI	a200	1934-36
	STREAMS TRIBUTARY TO LAKE MICHIGAN		
04046000	Black River near Garnet, MI	a28	*1951-78
04046500	South Manistique Lake Outlet at Curtis, MI	a44	1942-44
04047000	North Manistique Lake Outlet at Helmer, MI	a15	1942-44
04047500	Manistique River near Germfask, MI	a120	1942-50
04048000	Fox River at Seney, MI	107	1942-44
04048500	East Branch Fox River near Germfask, MI	104	1942-44
04049000	Holland Creek near Seney, MI	a13	1938-42
04049500	Manistique River at Germfask, MI	341	*1938-70
04050000	Goose Pen Outlet [illegible] Germfask, MI		1939-41
04050500	Grays Creek near Germfask, MI	a36	1938-40
04051000	Pine Creek near Germfask, MI	a11	1938-40
04051500	Sand Creek near Germfask, MI	a6	1938-40
04052000	Driggs River near Seney, MI	a70	1938-42
04052500	Walsh Creek near Seney, MI	a12	1938-42
04053000	Driggs River near Germfask, MI	114	1938-41
04053500	Marsh Creek near Shingleton, MI	a20	1938-42
04054[illegible]00	Marsh Creek near Germfask, MI		1938-41
04054500	Duck Creek near Blaney, MI	a92	1938-54
04055000	Manistique River near Blaney, MI	704	*1938-70
04055500	Creighton River near Shingleton, MI	a35	1938-42
04056000	West Branch Manistique River near Manistique, MI	322	1938-56
04057000	Indian River near Manistique, MI	302	*1938-71
04057500	Sturgeon River near St. Jacques, MI	167	1950-52
04057820	Middle Branch Escanaba River near Greenwood, MI	73.3	*1973-82
04057900	Black River near Republic, MI	34.4	*1961-68
04058000	Middle Branch Escanaba River near Ishpeming, MI	128	1954-75
04058100	Middle Branch Escanaba River near Princeton, MI	210	1961-82
04058130	Green Creek near Princeton, MI	13.8	1977-82
04058300	Warner Creek near Palmer, MI	14.2	*1961-68, 1972-78
04058400	Goose Lake Outlet near Sands Station, MI	37.5	*1966-82

See footnotes at end of table.

Station No.	Station Name	Drainage area (mi²)	Period of record
	STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued		
04058500	East Branch Escanaba River at Gwinn, MI	124	1955-80
04059400	Tenmile Creek at Perronville, MI	38.4	*1971-77
04060000	Iron River near Iron River, MI	a65	1901-04
04060500	Iron River at Caspian, MI	92.1	1948-80
04062100	Peshekee River near Michigamme, MI	66.5	1961-68
04062200	Peshekee River near Champion, MI	133	*1961-78
04062230	Michigamme River near Michigamme, MI	194	1969-82
04062270	Michigamme River near Champion, MI	231	1964-69
04062300	Michigamme River at Republic, MI	240	*1961-75
04062400	Michigamme River near Witch Lake, MI	316	1964-80
04065000	Menominee River near Iron Mountain, MI	a2,420	1898-99, 1903-14
04065300	West Branch Sturgeon River near Randville, MI	56.1	1958-81
04065393	East Branch Sturgeon River below Skunk Creek near Felch, MI	61.8	1974-84
04065397	East Branch Sturgeon River at Hardwood, MI	90.8	1978-83
04065500	Sturgeon River near Foster City, MI	237	1955-80
04065600	Pine Creek near Iron Mountain, MI	16.8	1972-81
04067000	Menominee River below Koss, MI	3,730	1907-09, 1913-81
04095500	Galien River near New Troy, MI	a47	1945-47
04096000	East Branch Galien River near New Troy, MI	19.2	1945-47
04096272	Beebe Creek near Hillsdale, MI	42.4	*1974-78
04096312	Sand Creek at Litchfield, MI	20.6	*1974-77
04096325	Soap Creek near Litchfield, MI	10.9	1975-77
04096340	St. Joseph River at Clarendon, MI	144	*1974-77
04096500	Sauk (East Branch Coldwater) River at Coldwater, MI	--	1938-62
04097000	St. Joseph River at Mendon, MI	918	1903-05
04097060	Little Portage Creek near Fulton, MI	27.0	*1965-67
04097170	Portage River near Vicksburg, MI	68.2	*1946-51, 1965-80
04097200	Gourdneck Creek near Schoolcraft, MI	7.29	1964-73
04097500	St. Joseph River at Three Rivers, MI	1,350	1953-83
04098500	Fawn River near White Pigeon, MI	192	*1903-04, 1958-75
04102000	St. Joseph River at Berrien Springs, MI	4,081	*1901-07, 1909-32, 1951-56
04102320	Paw Paw River near Paw Paw, MI	195	1980-82
04102420	Paw Paw River near Hartford, MI	311	1980-82
04102850	South Branch Kalamazoo River near Albion, MI	146	1972-76
04103000	Reed's Springs near Albion, MI	--	1905-06
04103500	Kalamazoo River at Marshall, MI	449	1949-82
04104000	Battle Creek at Charlotte, MI	a6[illegible]	1948-54
04104500	Battle Creek at Bellevue, MI	178	1948-53
04105800	Gull Creek near Galesburg, MI	38.1	*1965-73
04106190	Portage Creek near Portage, MI	18.6	1965-67
04106500	Portage Creek at Kalamazoo, MI	46.8	1948-58, 1975-86
04107000	Gun River at dam near Shelbyville, MI	a30	1946-47
04107500	Gun River near Martin, MI	a35	1946-47
04108000	Kalamazoo River near Allegan, MI	a1,470	1903-08
04109500	Portage River below Little Portage Lake near Munith, MI	a55	1944-56
04110000	Orchard Creek at Munith, MI	a49	1944-56
04110500	Portage River near Munith, MI	118	1944-46
04111000	Grand River near Eaton Rapids, MI	661	1951-82
04112904	Mud Lake Drain at Lansing, MI	4.28	1975-76
04113097	Carrier Creek near Lansing, MI	12.1	1975-80
04113500	Sebewa Creek near Sunfield, MI	24.1	1954-56
04115500	Fish Creek near Carson City, MI	145	1936-38
04116500	Flat River at Smyrna, MI	528	1951-86
04117000	Quaker Brook near Nashville, MI	7.60	*1954-75
04119300	Grand River at Eastmanville, MI	a5,230	1976-77
04120000	Crockery Creek at Slocums Grove, MI	--	1903
04120500	Higgins Lake Outlet (head of Muskegon River) near Roscommon, MI	49.2	1942-50
04121000	Muskegon River near Merritt, MI	355	*1947-74
04123000	Big Sable River near Freesoil, MI	115	*1942-74
04123500	Manistee River near Grayling, MI	123	*1943-74

See footnotes at end of table.

Station No.	Station name	Drainage area (mi^2)	Period of record
	STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued		
04124500	East Branch Pine River near Tustin, MI	60.0	*1952-63
04125000	Pine River near Le Roy, MI	128	*1952-63
04125500	Pine River near Hoxeyville, MI	251	1952-82
04126200	Little Manistee River near Freesoil, MI	178	*1957-75
04126500	Little Manistee River near Stronach, MI	a196	1931
04127500	Boardman River at Traverse City, MI	--	1903-04
	STREAMS TRIBUTARY TO LAKE HURON		
04128500	Indian River at Indian River, MI	598	1942-82
04129500	Pigeon River at Afton, MI	139	1942-81
04130000	Cheboygan River near Cheboygan, MI	889	1943-82
04131000	Rainy River near Onaway, MI	75.7	1942-52
04131500	Rainy River near Ocqueoc, MI	87.9	*1953-79
04132000	Black River near Cheboygan, MI	558	*1943-74
04132500	Thunder Bay River near Hillman, MI	232	*1945-73
04133000	Upper South Branch Thunder Bay River near Lachine, MI	171	1945-54
04133500	Thunder Bay River near Bolton, MI	588	1945-80
04134000	North Branch Thunder Bay River near Bolton, MI	184	1945-80
04134500	Lower South Branch Thunder Bay River near Hubbard Lake, MI	146	1945-54
04135600	East Branch Au Sable River at Grayling, MI	76.0	1958-84
04136000	Au Sable River near Red Oak, MI	a1,000	1909-16, 1931
04137000	Au Sable River at Bamfield, MI	a1,420	1902-14
04138000	East Branch Au Gres River at McIvor, MI	a84	*1951-74
04138500	Au Gres River near National City, MI	154	1951-81
04139000	Houghton Creek near Lupton, MI	29.7	*1950-73
04139500	Rifle River at "The Ranch" near Lupton, MI	56.8	1950-71
04140000	Prior Creek near Selkirk, MI	21.4	*1950-73
04140500	Rifle River at Selkirk, MI	117	*1950-82
04141000	South Branch Shepards Creek near Selkirk, MI	1.15	*1952-78
04141500	West Branch Rifle River near Selkirk, MI	a52	*1952-63
04142000	Rifle River at Omer, MI	364	1902-04
04143500	North Branch Kawkawlin River near Kawkawlin, MI	101	1951-82
04144000	Shiawassee River at Byron, MI	365	1948-83
04145500	Bad River near Brant, MI	a89	*1949-59
04146500	Flint River at Columbiaville, MI	470	1932-33, 1948-52
04147990	Butternut Creek near Genesee, MI	34.7	1970-84
04148000	Flint River at Genesee, MI	a593	1931-52
04148160	Gilkey Creek near Flint, MI	6.43	1970-84
04148200	Swartz Creek near Holly, MI	12.1	*1956-75
04148300	Swartz Creek at Flint, MI	115	1970-84
04148440	Thread Creek near Flint, MI	54.4	1970-84
04148720	Brent Run near Montrose, MI	20.8	1970-84
04149500	Flint River near Alicia, MI	--	‡1949-84
04150000	South Branch Cass River near Cass City, MI	238	1949-80
04151000	Cass River at Vassar, MI	710	*1910-28, 1949-70
04152500	Tobacco River at Beaverton, MI	487	1948-82
04153000	Kinney Creek near Clare, MI	a9	1935-36
04153500	Salt River near North Bradley, MI	138	1934-71
04154500	Chippewa River near Midland, MI	597	*1948-7[illegible]
04156500	Tittabawassee River at Freeland, MI	a2,530	1903-13, 1912-36
04157500	Sebewaing River (State Drain) near Sebewaing, MI	67.3	1940-54
04158500	Pigeon River near Owendale, MI	53.2	1953-82
04159000	Pigeon River near Pigeon, MI	93.3	1947-52
	STREAMS TRIBUTARY TO ST. CLAIR RIVER		
04159488	Silver Creek near Jeddo, MI	20.6	1978-82
04160000	Mill Creek near Abbottsford, MI	185	*1947-64
04160050	Black River near Port Huron, MI	684	1931, 1933-44

See footnotes at end of table.

Station No.	Station Name	Drainage area (mi^2)	Period of record
	STREAMS TRIBUTARY TO LAKE ST. CLAIR		
04161000	Clinton River at Auburn Heights, MI	123	*1935-40, 1957-82
04161820	Clinton River at Sterling Heights, MI	309	1979-83
04162000	Red Run near Royal Oak, MI	36.5	c1953-68
04162010	Red Run near Warren, MI	--	1980-88
04162500	Bear Creek at Warren, MI	17.3	1954-57
04162900	Big Beaver Creek near Warren, MI	--	1959-88
04163000	Big Beaver Creek at Warren, MI	25.2	1954-58
04163500	Plum Brook near Utica, MI	22.9	1954-66
04163900	Red Run near Cady, MI	--	‡1980-82
04164010	North Branch Clinton River at Almont, MI	9.56	*1963-68
04164050	North Branch Clinton River near Romeo, MI	49.7	*1965-69
04164150	North Branch Clinton River near Meade, MI	89.6	*1968-72
04164200	Coon Creek near Armada, MI	10.0	*1966-70
04164250	Tupper Brook at Ray Center, MI	8.62	*1960-64
04164350	Highbank Creek near Armada, MI	14.9	*1965-70
04164360	East Branch Coon Creek near New Haven, MI	36.1	*1968-72
04164400	Deer Creek near Meade, MI	12.7	*1960-65
04164450	McBride Drain near Macomb, MI	5.79	*1960-64
04164600	Middle Branch Clinton River near Macomb, MI	22.2	*1965-69
04164800	Middle Branch Clinton River at Macomb, MI	41.0	*1963-68, 1970-82
04165000	Middle Branch Clinton River near Mount Clemens, MI	a51	1947-49
04165200	Gloede Ditch near Waldenburg, MI	16.0	*1959-64
04165556	Clinton River By-Pass below weir at Mount Clemens, MI	--	‡1980-83
04165557	Clinton River By-Pass at mouth at Mount Clemens, MI	--	‡1980-83
	STREAMS TRIBUTARY TO DETROIT RIVER		
04168500	Lower River Rouge at Dearborn, MI	91.9	1931-33
	STREAMS TRIBUTARY TO LAKE ERIE		
04169000	Hayes Creek at Commerce, MI	a8	1946-51
04169500	Huron River at Commerce, MI	57.3	*1946-75
04171000	Davis Creek near Whitmore Lake, MI	65.8	1953-54
04171500	Ore Creek near Brighton, MI	a31	1951-68
04172500	Portage River near Pinckney, MI	79.1	*1945-71
04173000	Huron River near Dexter, MI	522	*1904, 1946-72, 1976-77
04173500	Mill Creek near Dexter, MI	128	1952-83
04174000	Huron River at Dexter, MI	--	‡1904-16
04174800	Huron River at Ypsilanti, MI	807	1974-84
04175340	Stony Creek at Oakville, MI	68.0	1970-81
04175500	Huron River at Flat Rock, MI	851	1904-11, ‡1912-22
04175700	River Raisin near Tecumseh, MI	267	1956-80
04176400	Saline River near Saline, MI	94.6	*1966-77

* Previous or subsequent operation as a crest-stage partial-record station.
‡ Stage record only.
a Approximately.
b Revised.
c Records available in District Office only.

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October 1, 1978

FACTORS FOR CONVERTING INCH-POUND UNITS TO INTERNATIONAL SYSTEM UNITS (SI)

The following factors may be used to convert the inch-pound units published herein to the International System of Units (SI).

Multiply inch-pound units	By	To obtain SI units
	Length	
inches (in)	2.54×10^{1}	millimeters (mm)
	2.54×10^{-2}	meters (m)
feet (ft)	3.048×10^{-1}	meters (m)
miles (mi)	1.609×10^{0}	kilometers (km)
	Area	
acres	4.047×10^{3}	square meters (m^2)
	4.047×10^{-1}	square hectometers (hm^2)
	4.047×10^{-3}	square kilometers (km^2)
square miles (mi^2)	2.590×10^{0}	square kilometers (km^2)
	Volume	
gallons (gal)	3.785×10^{0}	liters (L)
	3.785×10^{0}	cubic decimeters (dm^3)
	3.785×10^{-3}	cubic meters (m^3)
million gallons	3.785×10^{3}	cubic meters (m^3)
	3.785×10^{-3}	cubic hectometers (hm^3)
cubic feet (ft^3)	2.832×10^{1}	cubic decimeters (dm^3)
	2.832×10^{-2}	cubic meters (m^3)
cfs-days	2.447×10^{3}	cubic meters (m^3)
	2.447×10^{-3}	cubic hectometers (hm^3)
acre-feet (acre-ft)	1.233×10^{3}	cubic meters (m^3)
	1.233×10^{-3}	cubic hectometers (hm^3)
	1.233×10^{-6}	cubic kilometers (km^3)
	Flow	
cubic feet per second (ft^3/s)	2.832×10^{1}	liters per second (L/s)
	2.832×10^{1}	cubic decimeters per second (dm^3/s)
	2.832×10^{-2}	cubic meters per second (m^3/s)
gallons per minute (gal/min)	6.309×10^{-2}	liters per second (L/s)
	6.309×10^{-2}	cubic decimeters per second (dm^3/s)
	6.309×10^{-5}	cubic meters per second (m^3/s)
million gallons per day	4.381×10^{1}	cubic decimeters per second (dm^3/s)
	4.381×10^{-2}	cubic meters per second (m^3/s)
	Mass	
tons (short)	9.072×10^{-1}	megagrams (Mg) or metric tons

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